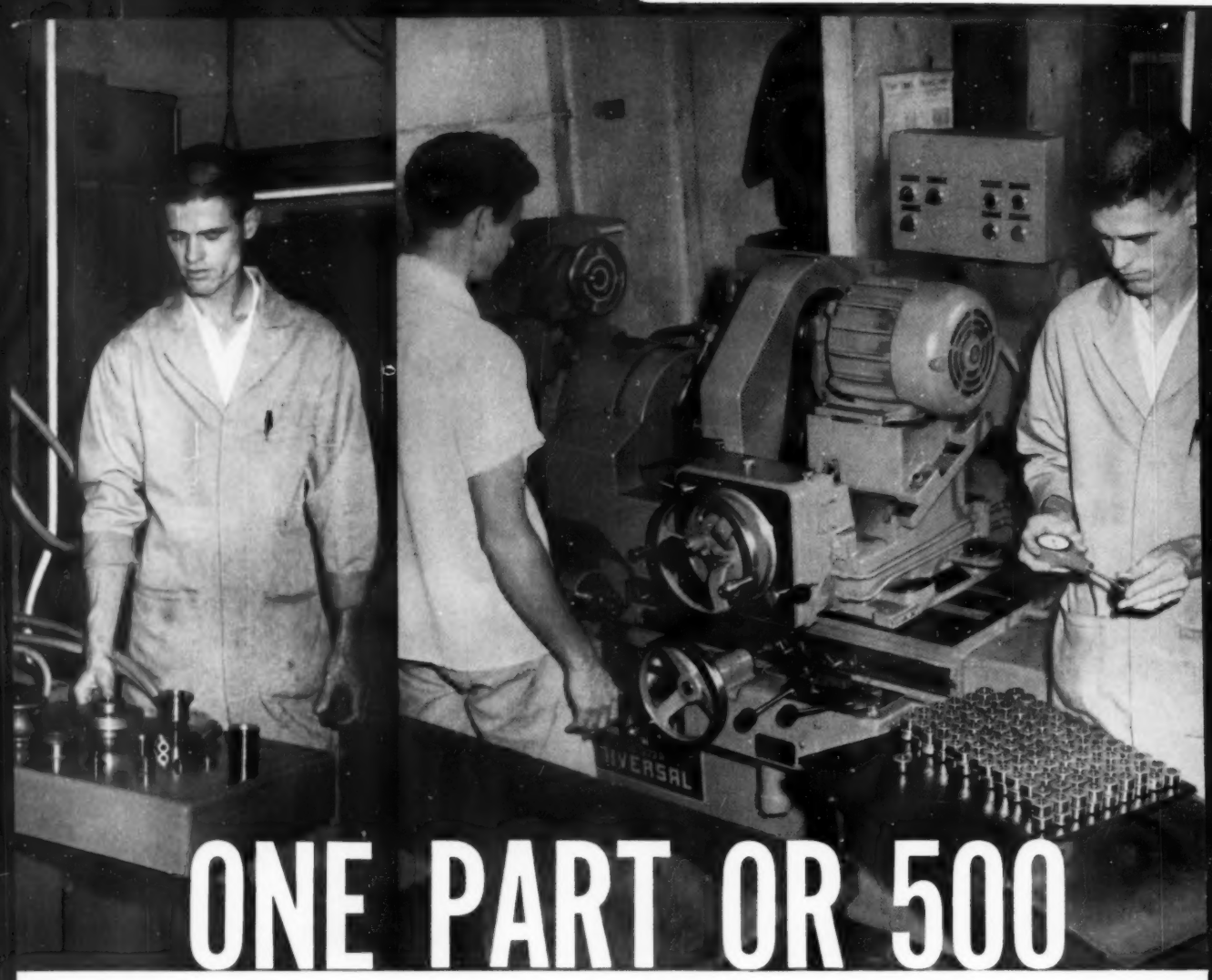
the

TOOL ENGINEER

NOVEMBER 1959

inspection

PUBLICATION OF THE AMERICAN SOCIETY OF TOOL ENGINEERS



ONE PART OR 500

Selco gets top grinding performance at rock-bottom cost with the

NEW HEALD MODEL 273A UNIVERSAL

The Heald Model 273A Universal Internal Grinder shown above is installed at the Selco Grinding Company — a small but busy job shop in southern California. Here it is used to grind straight or tapered I.D.s and O.D.s, and for rotary surface grinding of flat, convex or concave surfaces of a wide range of work — from individual parts to production runs. And it easily handles every job with far greater speed, accuracy, precision and finer finish than could be obtained on any of their previous equipment.

Until the advent of this Universal Grinder, most small job shops (and many larger ones, too) couldn't afford a machine of this type. But the Heald 273A costs about *half* as much as comparable machines today, and less than similar machines (with fewer features) cost in 1947!

Incorporating the latest advances in the grinding art, it holds tolerances to within .0001" in routine production, and within .000050" in special cases. Features include hydrostatic antifriction ways, full 20" table travel, several wheelhead positions, infinitely variable workhead speed from 150 to 450 rpm and 90 degree workhead swivel for rotary surface grinding.

Ask your Heald engineer for information on the New 273A — the only completely new machine with 1959 performance and a 1947 price tag.

THE HEALD MACHINE COMPANY

Subsidiary of The Cincinnati Milling Machine Co.

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HEALD

It PAYS To Come To Heald

the tool engineer

Vol. 43, No. 5

November 1959

Creative Manufacturing is TOOL ENGINEERING

Realistic Depreciation Policies ..... *By Joel Barlow and Gordon Henderson* 73
Nearly 50 percent of American metalworking equipment is obsolete. Revision of present tax policies would stimulate modernization.

Gadgets 79
Pin arbor for workpiece clamping . . . method for protecting dial indicators . . . driving standard for lathe arbors . . . number marking jigs.

Numerically Controlled Inspection ..... *By William B. Johnson* 82
Tape-controlled inspection is a logical outgrowth of tape-controlled machining. It can lead to impressive savings.

Standardization Speeds Production ..... *By P. B. Messina* 85
When planning for manufacture, use of common components in several products can make automation economically feasible.

How To Machine Zirconium Alloys ..... *By A. O. Schmidt and J. R. Roubik* 87
Despite their classification as exotic materials, zirconium alloys can be readily machined when their characteristics are known.

Positional Tolerancing Cuts Scrap Losses ..... *By R. S. Roth* 93
Conventional bilateral tolerances lead to confusion as to design intent. Positional tolerances end misunderstandings.

Inspection and Decision by Electronics ..... *By David R. Houck* 99
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Weight Reduction through Tolerance Control ..... *By George A. Hoffman* 107
Additional manufacturing operations to obtain closer tolerances on sheet material lead to improved aircraft performance.

Automatic Die Sinking—A Progress Report ..... *By T. W. Black* 112
Programmed machining of forging dies is now a production reality. It can be faster and more accurate than conventional methods.

Turning Titanium (Reference Sheet) 119
High temperatures generated in cutting titanium reduce tool life. This life can be increased by proper tool geometry, feeds and speeds.

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THIS MONTH'S COVER

Inspection of contoured parts can be performed automatically by numerical control. Here a probing head follows the contours of an aircraft engine turbine blade. Movements of the head have been previously programmed on a control tape. The amount of deviation between actual dimensions and blueprint dimensions is recorded on a strip chart. Full details are given in the article starting on page 82.

THE TOOL ENGINEER is regularly indexed in the *Engineering Index Service* and *Applied Science & Technology Index.*

Electronic parts courtesy Judson Mfg. Co., Inc., Cornwells Heights, Pa.

Mirror-bright without polishing, after switch to Sunicut

Boring on a multiple-spindle automatic produced the finish you see on these electronic parts. Sunicut 102-S Cutting Oil saved time and money by eliminating the polishing operation. The same automatic uses Sunicut 102-S to machine metals ranging from titanium to stainless 410.

Sunicut 102-S is one of a full line of cutting oils known throughout metalworking for maintaining long tool life, close tolerances, and fine finishes. There's a grade of Sunicut that can help you improve your product quality—and *that's* the best economy of all.

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Adventures in Progress

Fittingly, "Adventures in Progress" was the theme selected by the Cincinnati Milling Machine Co. for observing its seventy-fifth anniversary. Celebration of the anniversary was dramatized with impressive showmanship of amateur, but sincere, actors recruited from employees. History, developments and potential of the industry were portrayed effectively and in an interesting manner characteristic of the stage.

For a company that is known throughout the world for its leadership in research and development and for its excellence of product, the show was natural and in character. Even the fantastic seemed believable.

So-called, "chipless machining, "processes characterized the current trends in development. Unusual and intricate shapes were produced by an internal swaging machine, making a part with cammed surfaces and helical grooves. Electrodischarge machining and electrolytic grinding also performed practical as well as dramatic operations. An impressive demonstration compared the performance of the new 15-inch lathe with its counterpart of ten years ago. In addition to outperforming the older machine, its price is 10 percent less.

A tour through the plant shows that management practices what it preaches. Numerical controls are used for many machine operations. Each new machine doing production operations is labeled with a flag. In some departments, the flags predominate.

Cincinnati Chairman, Frederick Geier, keynoted the celebration and pointed out that "our very survival as a nation depends in large part on progress in machine tools." He also said that we dare not lag in science, technology, or industry. Excessive costs can put the price of survival beyond the nation's reach.

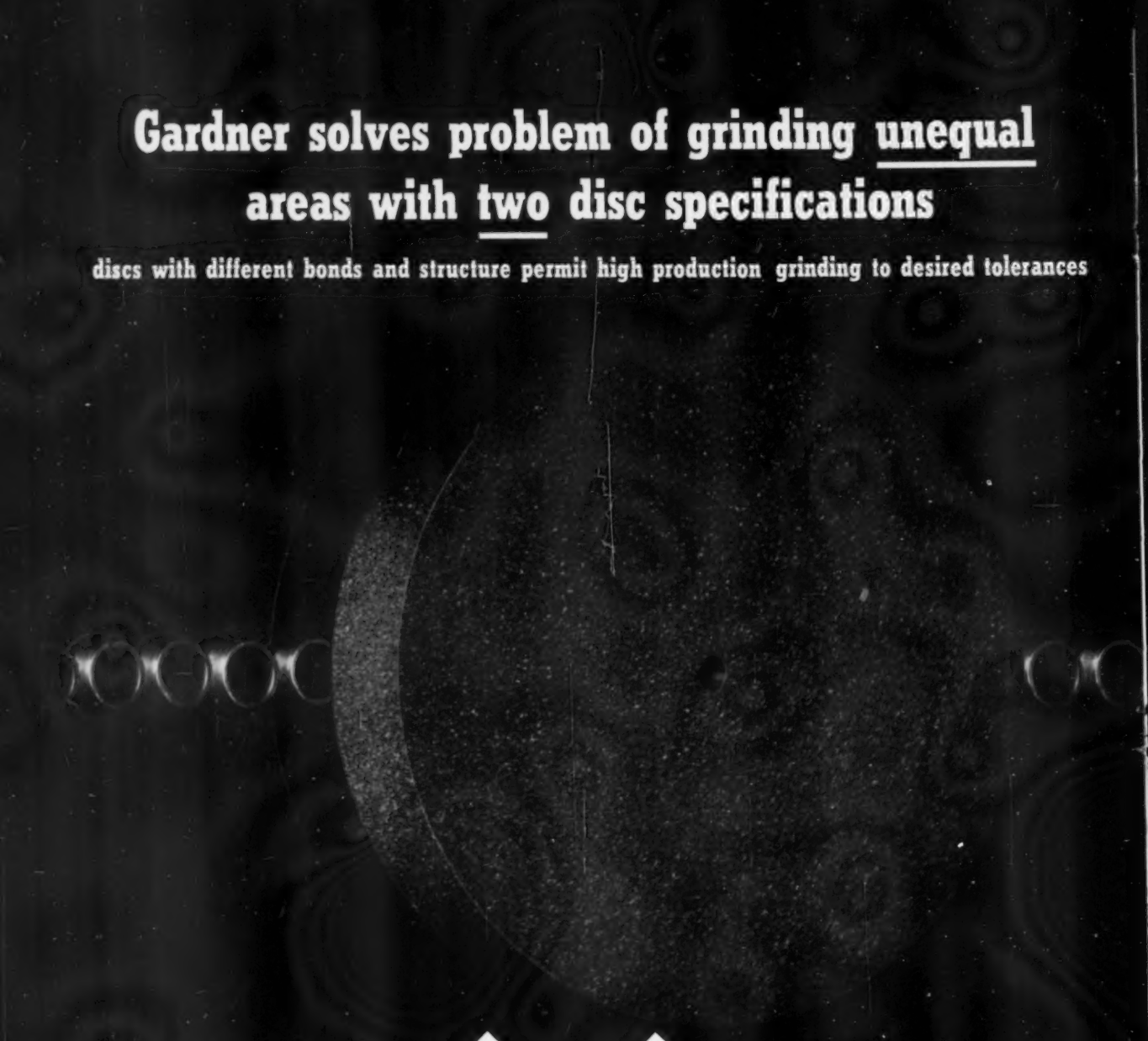
The tool engineer has his job charted clearly. Let everyone do his part.

John W Greve

EDITOR

Gardner solves problem of grinding unequal areas with two disc specifications

discs with different bonds and structure permit high production grinding to desired tolerances

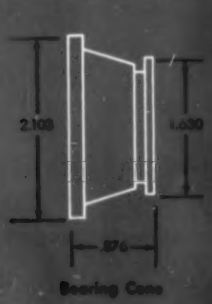


Gardner BGR disc specification

- wider grain spacing
- deep grain penetration
- effective chip clearance

Gardner BKGR disc specification

- fast stock removal
- cool cutting
- effective chip clearance



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The Only MASTER COLLET
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Style "S"
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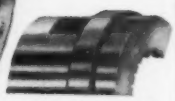
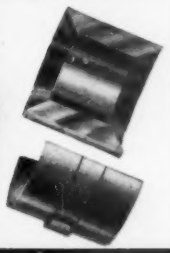


Pads Interchangeable
Among Different
Makes of Automatics



Style "B"
Master Feed Fingers and Pads

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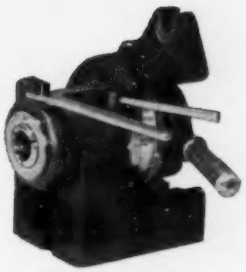
Write for Style "S" Bulletin Style "B" Bulletin

H-4 Tool Room-Inspection



HV-4 Production

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Increase Production by
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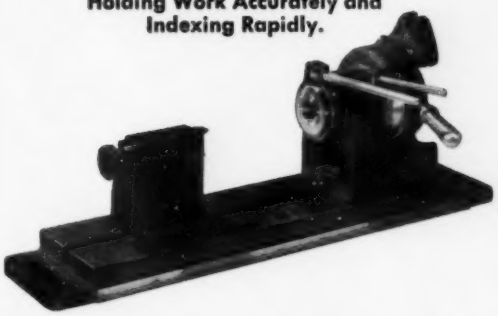

HARDINGE BROTHERS, INC., Elmira, N. Y.
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Fast — Accurate
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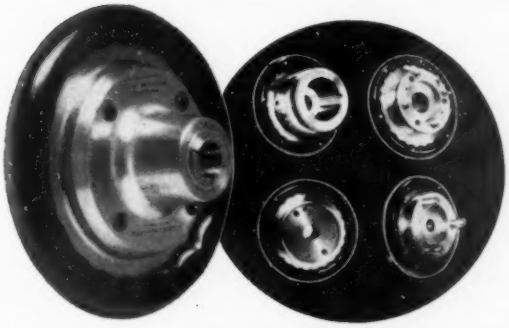

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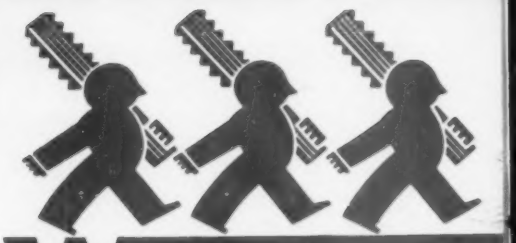
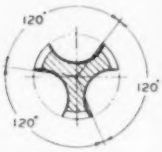


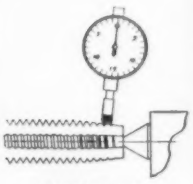
WINTER

UNIFORM FLUTE CONTOURS



EXACT FLUTE SPACING

PRECISION CHIP DRIVER CONTOURS



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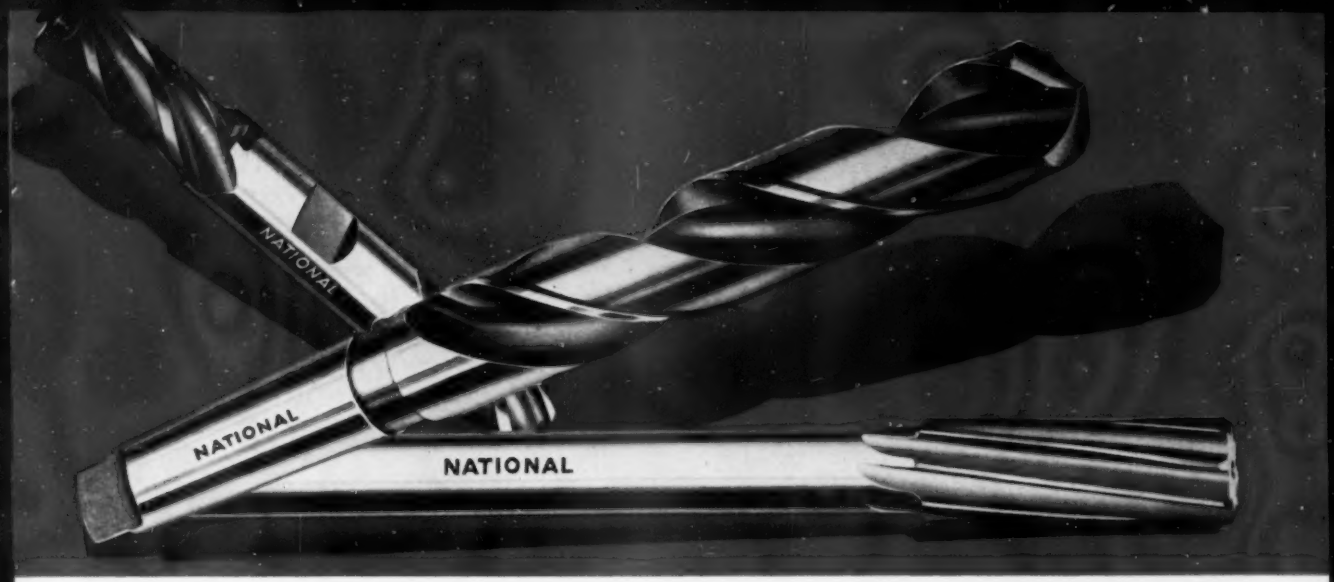

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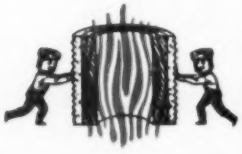

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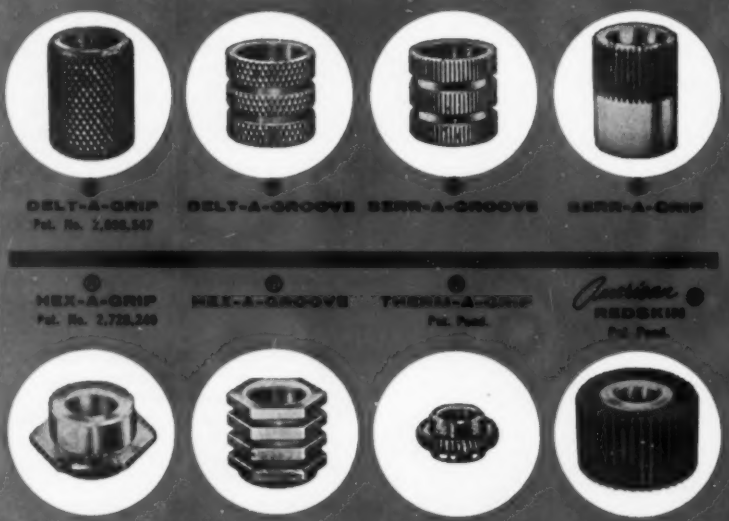

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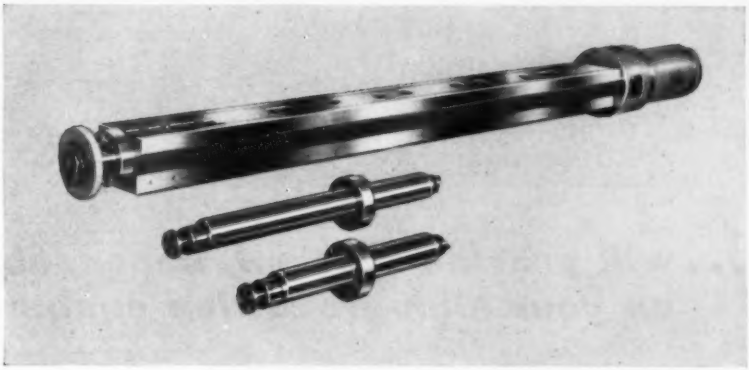

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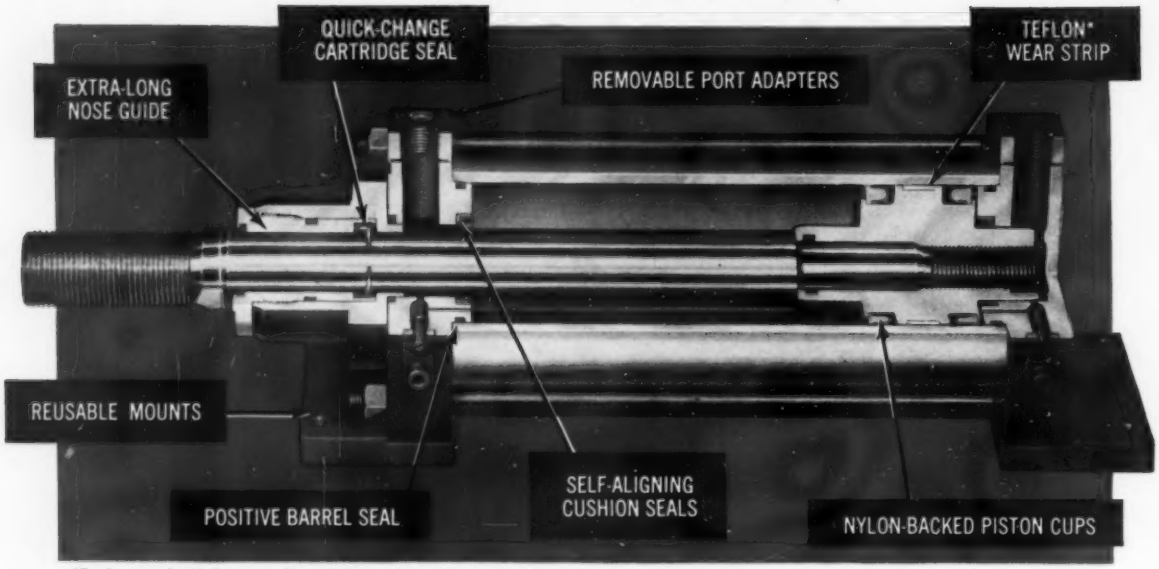

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. . . will provide efficient, dependable service on your high-production equipment

A look inside shows you why Valvair heavy-duty cylinders belong on *your* high-production machines! Built by Valvair, makers of famous SPEED KING valves, these heavy-duty cylinders provide design, construction and component material features coordinated to assure efficient operation, longest service life and minimum downtime.

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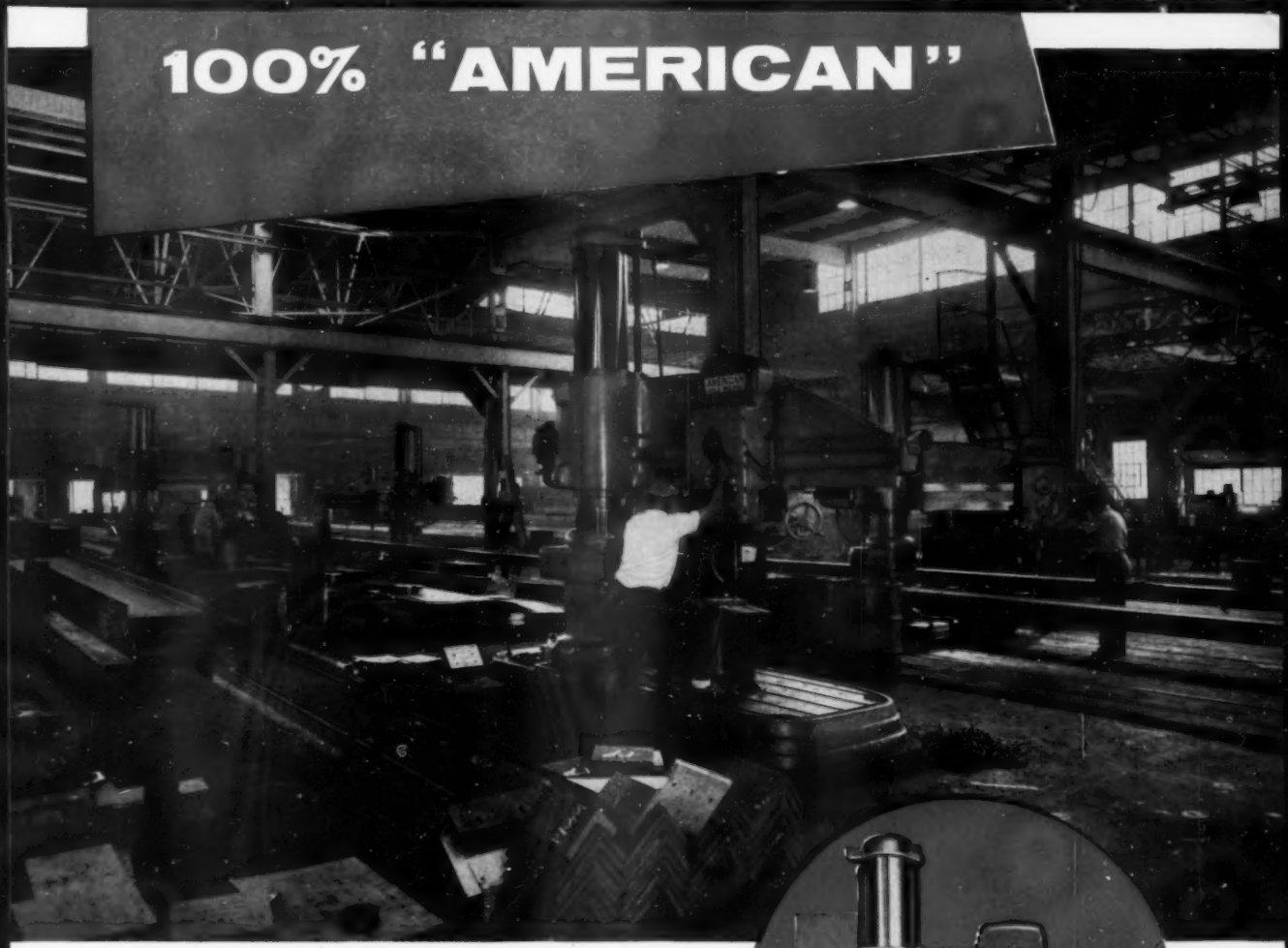

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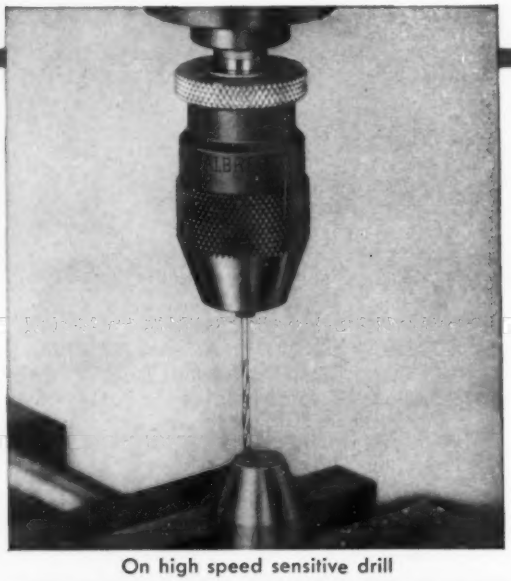
ALBRE

The world's most accurate keyless

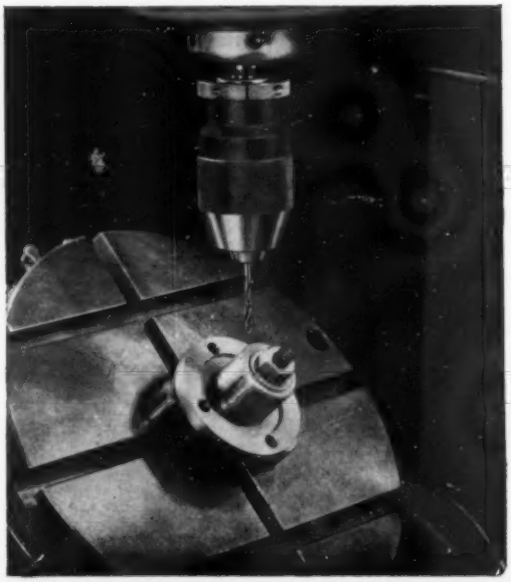
On milling machine

The Albrecht Drill Chuck at work in production and in the tool room.



On high speed sensitive drill

Model 15 for small drills (.008" shank)



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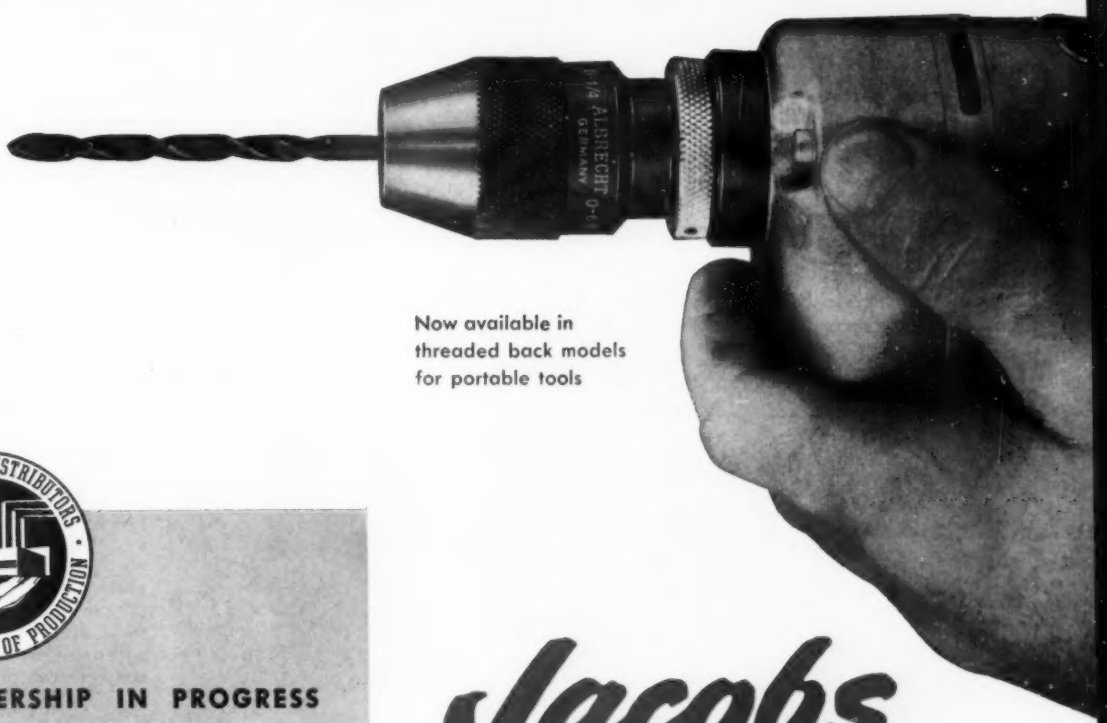
CHT

drill chuck!

Albrecht Heavy Duty Drill Chuck

8 threaded back models—capacities 0-⅝"

12 taper mounted models—capacities 0-⅝"



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Jacobs
CHUCKS

The Jacobs Manufacturing Company
West Hartford 10, Connecticut

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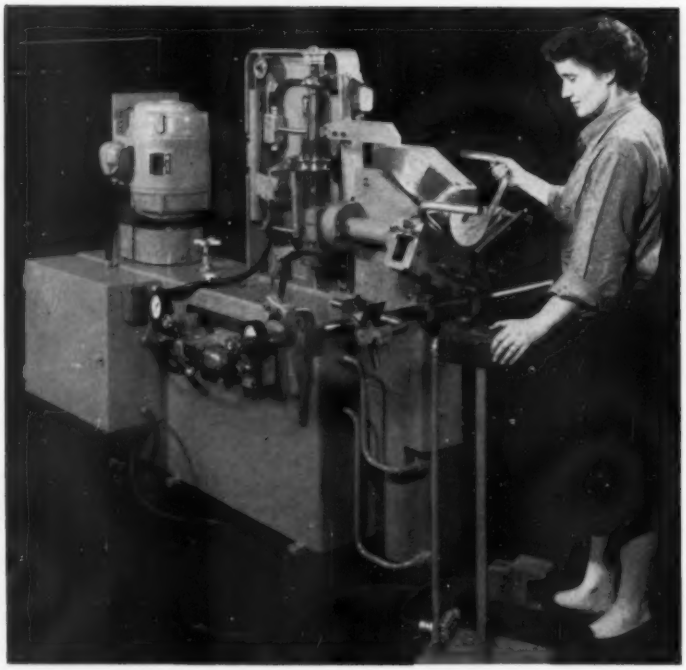


Makes Bends Progressively to Varied Angles In Multiple Planes 2 to 3 Times Faster

Quality bends at production speeds that are 2 to 3 times faster than conventional methods, are now possible with the new Pines 3-T Bending Press. Many tubular parts in sizes up to 1" O.D. are now formed at net speeds of over 1000 bends an hour. Up to 9 different bend angles can be produced in a single setup. Adjustable automatic indexing stops accurately control depth of ram stroke. Open tooling area permits rapid progressive bending in varied planes.

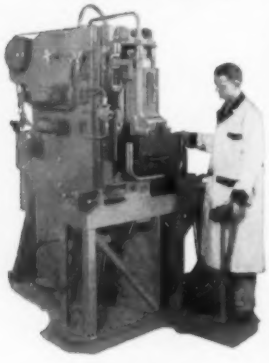
Wing Die Design Assures Quality Bends

High production speed is just part of the story. Unusually smooth, good looking bends are produced to meet the quality demands of automotive, furniture, toy, office equipment, and appliance manufacturers. Wing dies of the press are designed to move in ways as a bend is made, and their pivoting action is hydraulically cushioned through bearing-mounted rocker arms. This principle eliminates scratches or draw marks and produces wrinkle-free bends with very little distortion. Get the complete story on cost cutting advantages of this new Bending Press today.

COMPLETE LINE OF BENDING PRESSES

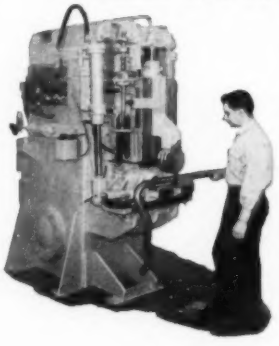
In addition to the Model 3-T, Pines also builds the larger bending presses, illustrated below, which are also establishing outstanding performance records.

MODEL 6T FOR MULTIPLE U-FRAME BENDING



Makes two bends of the same or slightly different angles in each of two or more tubes simultaneously. Production of four or more bends with each stroke makes it possible to form 1700 to 3000 bends per hour in tube sizes ranging up to 1" O.D. x .065". When necessary, retractable ram dies are used to release pieces from die grooves. Like 3-T, wing dies move with work, eliminating draw marks, producing bends of superior quality.

MODEL 1900 FOR PROGRESSIVE BENDING OF TUBES UP TO 2" O.D.



Designed for high speed bending of parts requiring a variety of bends in different planes, such as automotive exhaust and tail-pipes, or similar work. Major features are automatic angle indexing and greater working clearance which permits completing, for example, 90% of all bends in a tail-pipe with a single tooling setup. Press handles stock sizes up to 2" O.D.

PINES ENGINEERING CO., INC.

Specialists in Tube Fabricating Machinery

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PRODUCTION BENDING • DEBURRING • CHAMFERING MACHINERY

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BUTTERFIELD

BUTTERFIELD DIVISION, UNION TWIST DRILL COMPANY, DERBY LINE, VERMONT

USE READER SERVICE CARD, CIRCLE 10

SWITCHING TO ADAMAS CARBIDE GRADE 548 GIVES OLIVER 170 MORE PIECES PER INSERT

-cuts downtime by 75%

Oliver Corporation—never satisfied until they are sure they have the best—wanted greater production, per carbide cutting edge, in machining front tractor wheels. Shown discussing the problem are Lyle Bushbaum, Divisional Foreman; A. G. Obermeier, Shop Supt.; of Oliver's Charles City, Iowa plant; and Adamas Service Engr., Walter Sukiennik.

The machines in use are P & J automatic turret lathes. Using brazed tools on the hard cast iron parts, production never exceeded 50 pcs. per sharpening. Mr. Bushbaum, examining the operation, considered using throwaway inserts but questioned their ability to stand up under the heavy shock conditions.

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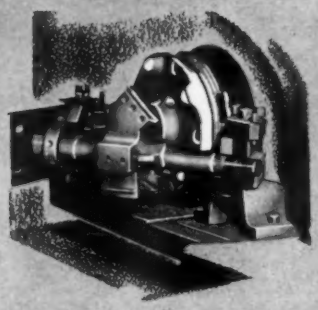
If you are interested in improved efficiency, economy, quality — let's hear from you . . . the coupon is for your convenience.



It was finally decided to set up the lathes with Adamas' Dex-A-Tools and Grade 548 throwaway inserts. This combination proved to be very rugged, and efficiently handled the operations involving a series of interrupted cuts of 3/16" in depth, with a .017 feed at 340 sfpm.

The change to Adamas' Dex-A-Tools and Grade 548 enables Oliver to step up production to 480 pieces per carbide insert and drastically reduce downtime. This is in sharp contrast to the previous output of 50 pcs. per sharpening with a well known competitive grade. Production per corner now averages 80-100 pcs.

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PRODUCTION POINTERS

from **GISHOLT**

MASTERLINE GISHOLT SINCE 1887

FIVE FASTERMATICS SAVE 46% ON PANHARD AND LEVASSOR "PL17" CRANKSHAFT ARMS

Fixtures, smart tooling and machine features simplify work on tough steel forgings

Fixture work giving you headaches—in lengthy machining times, high tool costs and excessive reject rates? You may find some new answers by checking this setup at Panhard and Levassor Automobiles, Paris, France, plant.

Nine semi-automatic lathes were used to produce a wide variety of steel crankshaft arm forgings in lots of 500 to 1000 pieces. Time cycles were lengthy. Parts were hard to hold and machine, and consistent quality was a problem. As a part of its quality improvement and modernization program, the firm investigated various other methods.

Gisholt MASTERLINE 1F Fastermatic Automatic Chucking Turret Lathes, with smart fixturing and standard tooling, were found to best meet this company's needs for consistent quality, versatility, quick setup and lower production costs.

For the first operation on a typical part, framed at left, below, the rough forging is placed in a special chucking fixture. This fixture is adjustable for all sizes of parts. Jacks locate longitudinally. The counterweight rests in a stationary V-block, locating for height. A V-shaped centralizing jaw grips from the opposite side. Two additional jaws, at the left and right, also grip the work.

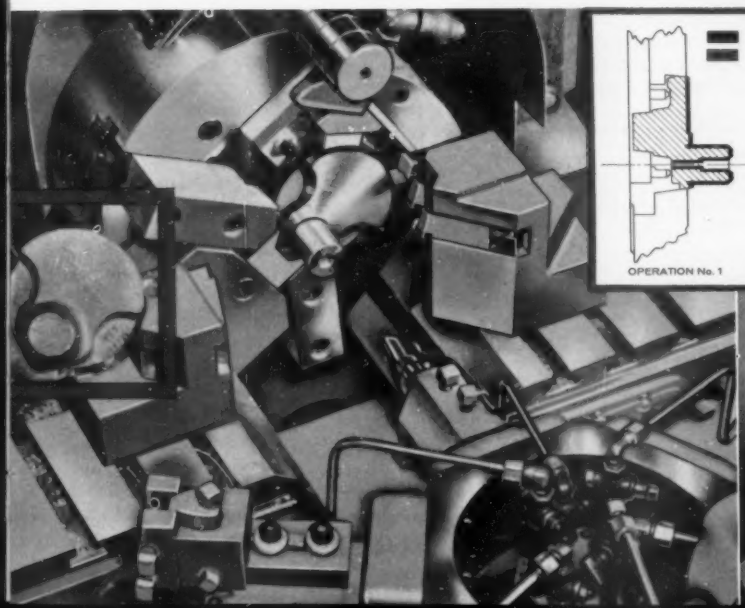
The heavy black surfaces on the drawing are machined from the hex turret. Facing of the hub, the counterweight and thrust bearing surfaces, shown in red, is handled from the front and rear cross slides. Floor-to-floor time is a fast 5.2 minutes.

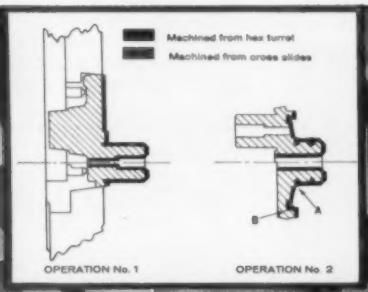
The second operation on a second 1F Fastermatic completes the opposite or crank end of the part. Work is chucked and located on previously machined surfaces. Front and rear cross slide tools face the crank end, the outer edge of the flange, and form one groove as shown in red on the Operation 2 drawing. All other machining handled from the hex turret is shown in black.

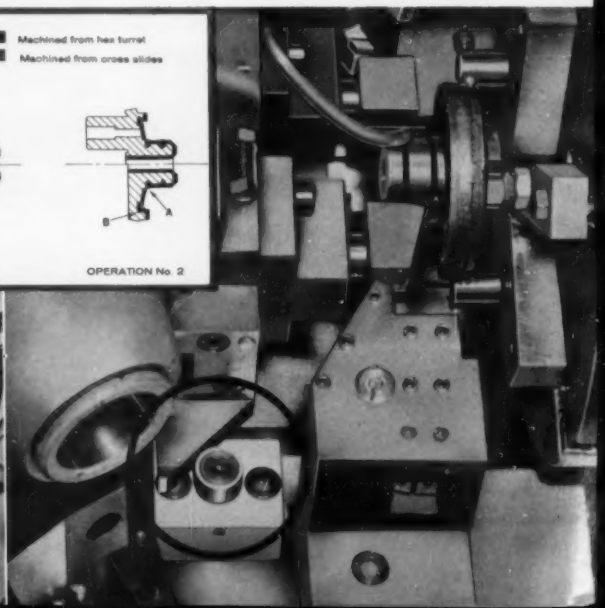
The grooving operation on Surfaces A and B is worth remembering. It is handled by two tools, in a cam-operated, turret-mounted, facing slide tool. Tool clearance problems are solved by an angle cam, mounted on the slide tool. Forward movement of the hex turret saddle engages the angle cam with a roller bearing on the rear cross slide top (encircled at lower right). Continued forward movement of the turret saddle forces the slide tool to move transversely, engaging one tool on each side of center. Reverse of the hex turret saddle at the end of the cut provides automatic tool relief. Floor-to-floor time for this operation, 4.9 minutes.

Five 1F Fastermatics replace nine older lathes. Savings include 46% less machining time, 40% less change-over time, 15% longer tool life. Surface finish is improved and closer tolerances are held. Productivity is increased, too, because the automatic machining cycle permits each operator to handle two machines.

For complete facts on 1F Fastermatics, circle No. 1751 on inquiry card.







GLOBE OIL TOOLS THREADS 580% FASTER ON 28Rc STEEL ASSEMBLIES

One CRI-DAN "E" replaces four lathes, ups total production from 48 to 70 parts per day

Are you using thread grinders, thread millers or hand-operated lathes to perform threading operations on hard materials or tough jobs? You can probably make substantial savings in original equipment and tooling costs, and improve production rates as well, with the modern CRI-DAN method. Low-cost, single-point carbide tools, easily sharpened or replaced, are used to produce all types of threads to highest accuracy and finish. Higher speeds and feeds may be used. The automatic threading cycle assures repeat accuracy and, in many cases, permits the operator to perform additional work for added savings.

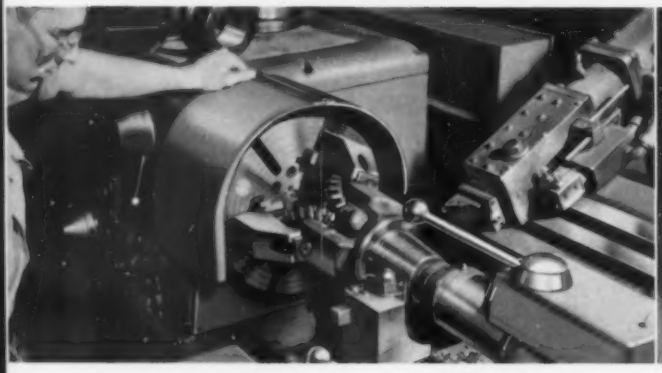
This setup at Globe Oil Tools Company, Los Nietos, California, is worth careful study. It shows you an easy way to cut costs, up production, and maintain the accuracy and fine finish you require in threading operations.

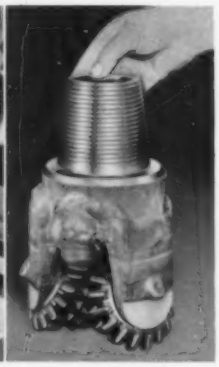
Previously, Globe Oil Tools used four engine lathes to machine the tapered threads on the pin ends of oil well rock bit assemblies. A typical, 8¾-size part is shown below.

Highly skilled men were needed to meet the accuracy and finish requirements of these hard-working parts. Production averaged 12 pieces per day, per machine, at 80% efficiency.

Now, with the setup shown on a CRI-DAN "E" Threading Lathe, production has increased to 70 parts per day at 80% efficiency. The automatic cycle reduced the operator's work to loading, starting the cycle, gaging, and removing the completed part. It allows him time to handle pre-threading operations on another automatic.

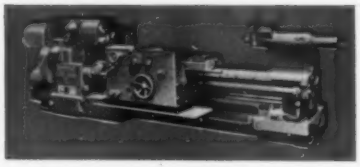
Work is gripped in a 3-jaw air chuck, locating against turned shoulders on each of the three segments of the welded assembly. The 4½ API, .117″-deep thread on the 8¾-size part shown is completed in 26 passes at 385 r.p.m. Tool "in-feed" is set to diminish with each pass—starting at .007″ and removing only .00175″ on the final pass. This assures highest accuracy and an extremely fine finish. A rear-mounted auxiliary slide bevels and faces the standoff shoulder, and relieves the threads at the large end. Threading time is 2.5 minutes.





Tough, 28Rc welded steel forging assemblies are threaded 580% faster using the CRI-DAN single-point carbide tool threading method. One CRI-DAN "E" replaces four engine lathes. CRI-DAN operator has time to handle another automatic.

For complete information on CRI-DAN "E", circle No. 2751 on inquiry card.



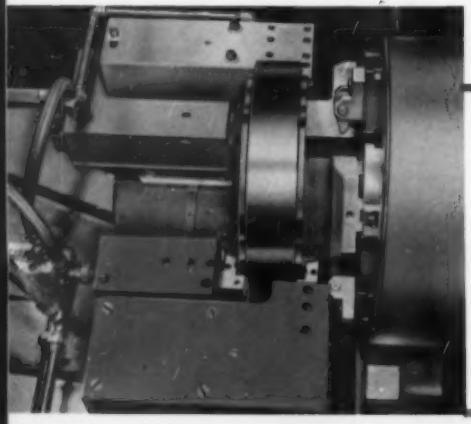
SPROUT, WALDRON & COMPANY HANDLES SMALL LOTS 400% FASTER

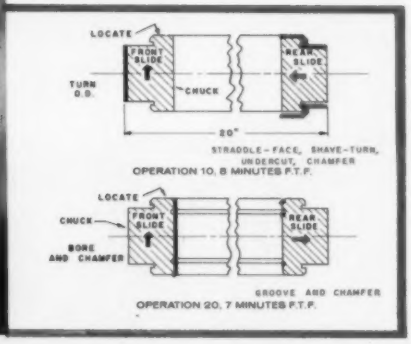
Versatile tooling, fast change-over on Simplimatic save on big parts

You may be paying premium rates to produce small lots on manual machines. Here's what happened when Sprout, Waldron & Company, Inc., Muncy, Pennsylvania, replaced two older lathes with one Gisholt MASTERLINE Simplimatic Automatic Lathe. Machining time was cut 400% on over 12 different sizes of forged steel pellet mill dies and roller shells. These are produced in lots of 20 to 100, and are used for compacting and densifying animal feeds, free-flowing plastic and chemical products.

The wide platen table of the Simplimatic provides maximum flexibility for placement of tool slides. Tools and tool blocks are designed for quick adjustment or replacement. Chuck jaw inserts accommodate different diameters. Complete change-over to different sizes on the same operation averages 20 to 25 minutes.

The first operation setup for a 20″-diameter, 5″ Simplex die is illustrated. Note the pivoting locators on the chuck, swung aside to permit machining front and back surfaces simultaneously. Table traverse positions the tools and standard slide movement is used to machine. The line drawings show the surfaces handled by the front and rear independent slides in two operations.





Quick setup and fast cycle handle big pellet mill dies 400% faster. Simplimatic replaces two older machines—eliminates all overtime and night-shift premium for these operations. Smart tooling reduces inventory requirements. Automatic cycle permits operator to do other work for added savings.

For complete facts on Simplimatic, circle No. 3751 on inquiry card.

ASK YOUR GISHOLT REPRESENTATIVE ABOUT FACTORY-REBUILT

HOW YOU CAN HOLD COSTS DOWN ON SPECIAL JOBS

MASTERLINE GISHOLT SINCE 1887

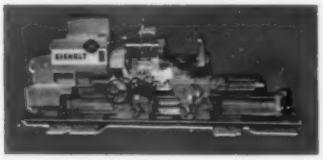
Indexing fixtures on standard saddle type turret lathes combine operations for economy and accuracy

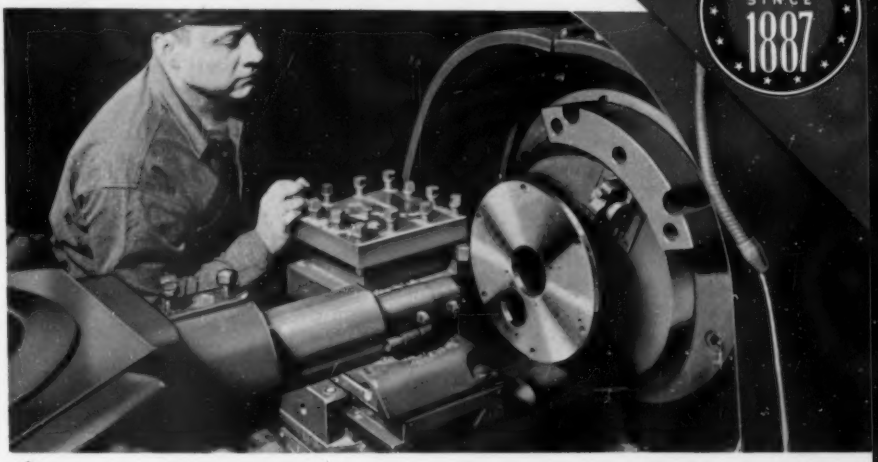
There may be a cost-cutting idea for you in the machining methods used by a well-known gear motor manufacturer. Here the problem was to reduce costs of machining housings with a wide variety of mountings, and various other component parts.

To produce such a great variety of types and sizes, this manufacturer relied on smart fixturing which allows operations to be combined on standard machines. The two setups shown here demonstrate how this approach offers improved accuracy and lower machining costs.

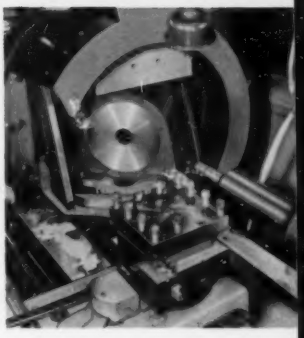
Unique fixturing on standard saddle type turret lathes handles 2-step jobs in one chucking—assuring greater accuracy and eliminating extra handling.

For complete facts on 5L Saddle Type Turret Lathes, circle No. 4751 on inquiry card.





Here a sliding type indexing fixture on a Gisholt 5L Saddle Type Turret Lathe is used for head and bearing plate assemblies. The O.D. of the 19.122″-diameter assembly shown is turned and the work is faced from the cross slide square turret. The "on-center" hole is bored from the hex turret. The operator then indexes the fixture about an eccentric axis, positioning the "off-center" hole for machining from the hex turret.



This Gisholt 5L Saddle Type Turret Lathe is tooled to face and bore four sizes of gear motor housings. The work is held in a counterbalanced faceplate fixture with an indexing base. It is faced from the cross slide square turret and finish-bored from the hex turret. It is then indexed 180° for identical machining on the reverse side. The indexing fixture eliminates extra handling and clamping. With this setup, bores are parallel within .001″, and round and straight within .0005″. F.t.f. times range from 27 to 47 minutes.

HOW CHRYSLER AIR TEMP BALANCES SMALL PARTS FASTER, MORE ACCURATELY

The trend to miniaturization, higher operating speeds and greater efficiency from working parts presents problems throughout manufacturing. Tolerances are especially critical in rotating parts, requiring accurate balance for long life and noise-free operation. The new Gisholt line of *"HS"* Bench-Type, High-Speed Balancing Machines provides a low-cost answer.

New Gisholt "HSV" (High-Speed Vertical) Balancer handles wide variety of small blower and fan wheels

The blower fans and wheels shown are typical of those used in automotive defroster and heating units produced by Chrysler Corporation's Air Temp plant in Dayton, Ohio. Light weight and operating speeds up to 4400 r.p.m. demand extremely accurate single-plane balancing.

The setup shown, on a Gisholt "HSV" Balancer, provided all the answers. Accuracy requirements were easily met since the machine clearly shows the angle and amount of unbalance causing vibrations as small as .000002″. Over-all balancing time was cut 50%. Setup was also speeded. Tooling costs were reduced by using simple adapters to locate work, and setscrews to hold and drive.

The defroster blower wheel shown on the machine is typical. It is 3¼″ in diameter and weighs four ounces. The strobe lamp indicates the exact angle of unbalance on a graduated disc that rotates with the work and adapter. A direct-reading amount meter, in the same visual plane, shows the correct-weight aluminum clip that must be "crimped" to the vane to balance within tolerance. Since the amount of unbalance is shown in *terms of the correction method used*, there is no need for a second rotation for inspection. Production is 60 or more pieces per hour at 80% efficiency.

New "HSV" Balancer cuts time 50% on this job...assures accuracy on small, lightweight, high-speed parts. Both vertical and horizontal "HS" Balancers are available. Belt-, air- or electrically self-driven parts or assemblies containing high-speed rotating parts may be handled. This includes miniature armatures, aircraft and missile gyros, small spindles, turbines, textile parts, etc.

For complete information, contact your Gisholt Representative or circle No. 3751 on inquiry card.

GISHOLT

MACHINES WITH NEW MACHINE GUARANTEE

HOW POWERS REGULATOR CO. IMPROVES DIMENSIONAL CONTROL ON VALVE BODIES

No. 5 Ram with indexing chuck and auxiliary stop completes four ends per chucking

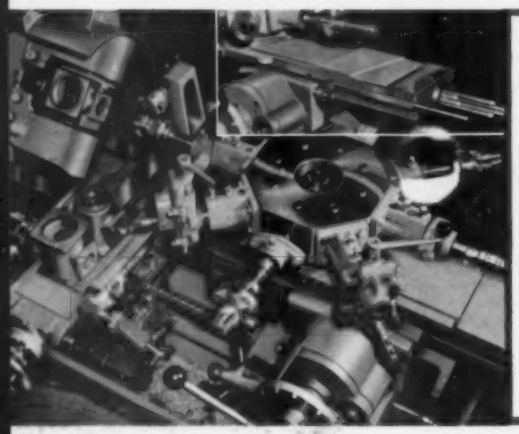
If your work involves tees, ells or crosses, you'll get some cost-cutting ideas from this setup, used by Powers Regulator Company, Skokie, Illinois. It assures concentricity, parallelism and highest accuracy by completing all four ends of brass valve bodies in one chucking.

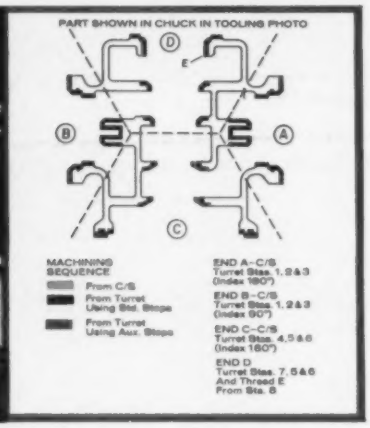
The basic setup on a Gisholt MASTERLINE No. 5 Ram Type Turret Lathe, shown below, handles three different sizes of parts. Four factors are responsible for improved dimensional control and reduced time on this job:

1) A 15", 2-jaw, air-operated, indexing chuck—that completes all four ends in one chucking.
2) An Octagon turret—with hollow mills and multi-diameter cutters to machine maximum surfaces per pass.
3) A retractable auxiliary stop for the turret ram, shown inset. Despite eight turret stations, all surfaces could not be completed. The answer—the standard ram stop roll to control length of cut on one end—an auxiliary stop to control length of cut on the opposite end—on stations 5 and 6.
4) "Tenth" indicator for speedy cross-slide setting.

The drawing and machining sequence data, left, shows how the special tooling is used. F.t.f. time on the part shown is 9.8 minutes.

If you are handling similar work, with two or more ends to be machined, circle No. 6751 on Inquiry Card for information on the Gisholt MASTERLINE Ram Type Turret Lathe and Gisholt Indexing Chucks.




PART SHOWN IN CHUCK IN TOOLING PHOTO
D
E
B
A
C
MACHINING SEQUENCE
From C/S
From Turret Using Std. Stops
From Turret Using Aux. Stops
END A—C/S Turret Stas. 1, 2 & 3 (Index 180°)
END B—C/S Turret Stas. 1, 2 & 3 (Index 90°)
END C—C/S Turret Stas. 4, 5 & 6 (Index 180°)
END D Turret Stas. 7, 5 & 6 And Thread E From Sta. 8

THOMPSON RAMO WOOLDRIDGE INC. CUTS FINISHING TIME, IMPROVES QUALITY ON GEARS

Superfinish corrects part geometry, provides smoother surface for greater operating efficiency

Looking for an economical way to obtain flatter, smoother, longer-lasting wear surfaces? Then study this Superfinishing setup used by Thompson Ramo Wooldridge Inc., Fuel Systems Works, Tapco plant, Cleveland, Ohio.

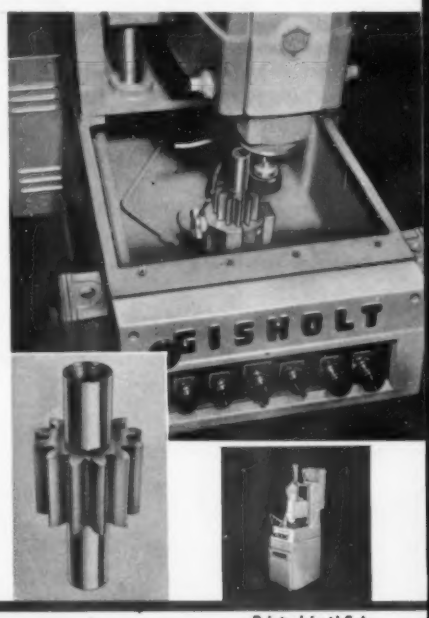
The workpiece, an aircraft fuel pump gear, is used to pump kerosene and gasoline. It requires a very flat, low micro-inch surface finish for most efficient operation. Here's how a Gisholt MASTERLINE Model 81 Superfinisher meets this requirement economically on four gear sizes.

Work is placed in a special fixture against an adjustable stop. On engaging the stop, the workpiece is given a counterclockwise turn to lock it in the fixture. The Superfinishing stone is then engaged. Stone pressure holds the work securely during the operation.

The work and the Superfinishing stone rotate in opposite directions. Some stock is removed during Superfinishing to correct surface geometry and provide the required flat face. Surface roughness is reduced to a "controlled" 1.5 micro-inches R.M.S. Cycle time for one face of the work is 1.5 minutes. To Superfinish the opposite face, the operator removes the part by twisting it clockwise, turning it end for end and repeating the operation. Total time for both faces is three minutes, f.t.f.

Superfinish eliminates grinding defects, improves surface geometry, exposes true base metal for longer surface life. Fixture permits completing both pump gear faces to required accuracy in minimum time.

For complete facts on Model 81 Superfinisher, circle No. 7751 on inquiry card.



No. 11-1259
751

The Gisholt Round Table represents the collective experience of specialists in the machining, surface-finishing and balancing of round and partly round parts. Your problems are welcomed here.

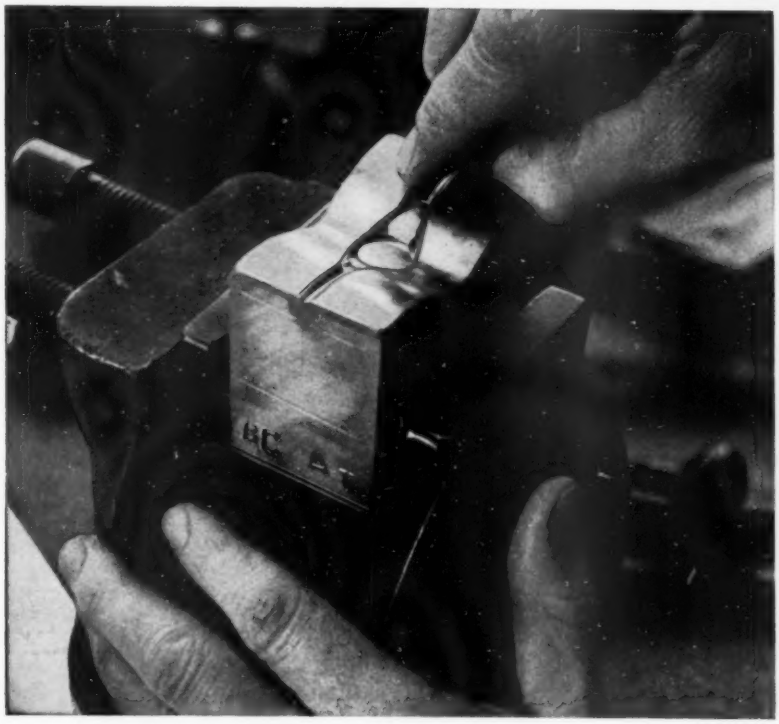
Printed in U.S.A.

GISHOLT MACHINE COMPANY Madison 10, Wisconsin

Turret Lathes • Automatic Lathes • Balancers • Superfinishers • Threading Lathes • Packaging Machines • Masterglas Molded Plastic Products

Tool Steel Topics

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.



BEARCAT EMBOSSES INTRICATE GOLD

10k gold strikings for class rings no problem for this outstanding shock-resisting tool steel

Bearcat tool steel is performing brilliantly at The Metal Arts Co., Inc., Rochester, N. Y., where it is used in embossing 10k gold ring shanks and bezels for high school and college class rings. Bearcat was suggested by our local tool steel distributor, The Burke Steel Co., Inc., Rochester.

"Of course there are other grades which might be satisfactory," the Burke representative told them, "but what you are looking for is outstanding shock-resistance. Put Bearcat to work in this job and you'll never be sorry."

At last report, the dies were bearing out the propheey. Hardened to Rockwell C-58-59, and operating in drop hammers, they had turned out thousands of the intricate gold strikings, without any sinking or breaking.

Bearcat, our super grade of shock-resistant air-hardening tool steel, takes shock jobs in stride, and has superior wear-resistance. And because it's air-hardened, Bearcat minimizes quenching hazards and distortion in heat-treatment.

Next time you're looking for a really tough tool steel, team up with Bearcat. You'll be glad you did.

BETHLEHEM TOOL STEEL ENGINEER SAYS:

Stainless Is Tough On Tools

Many items formerly made of soft steel are now being made of stainless steel. The austenitic stainless steels (AISI 300 series) are popular because of their corrosion-resistance, plus their strength and oxidation-resistance at moderately high temperatures.

Whenever stainless parts are made with tools formerly used on soft steel, there is a marked decrease of production of parts per tool. For example, on a simple blanking operation on stainless steel, the production per grind on the punch and die usually is about one quarter of the production on soft steel.

Though it is rarely possible to change conditions so that the "normal" tool life can be realized when making stainless parts, some improvements can be made. For example, if the blanking tools were originally made of AISI W1 water-hardening or O1 oil-hardening tool steels, a change to D2 high-carbon, high-chromium tool steel is suggested. This change will improve the tool life from two to three times. Or if D2 high-carbon, high-chromium tool steel is already being used, it may be necessary to carburize, or to nitride, in order to improve the wear-resistance. Close attention must be paid to mechanical conditions, such as proper clearance between punch and die, proper penetration of the punch, and optimum grinding procedures in finishing the tools.

Because stainless is tough on tools, careful planning is necessary for good tool life.

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BETHLEHEM TOOL STEEL LITERATURE

If you would like to have booklets on our tool steel grades, just check your choice below, and mail to Room 1045, Publications Department, Bethlehem Steel Company, Bethlehem, Pa.

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- ☐ High Speed
- ☐ Carbon and Carbon-Vanadium
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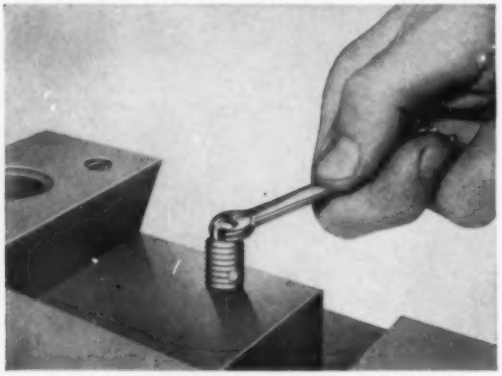
- ☐ Oil and Air Hardening
- ☐ Special Purpose
- ☐ Lehigh H (high-carbon, high-chrome)
- ☐ Bearcat
- ☐ Tool Steel Selector

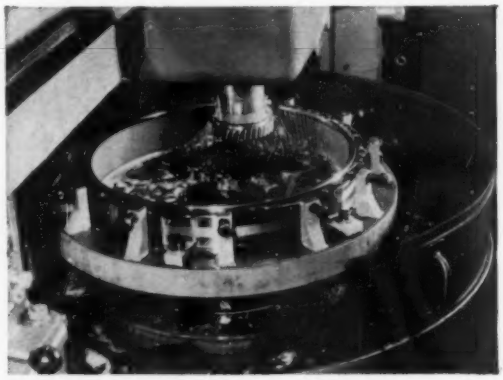
Practical Tooling Tips

No. 4 of a series

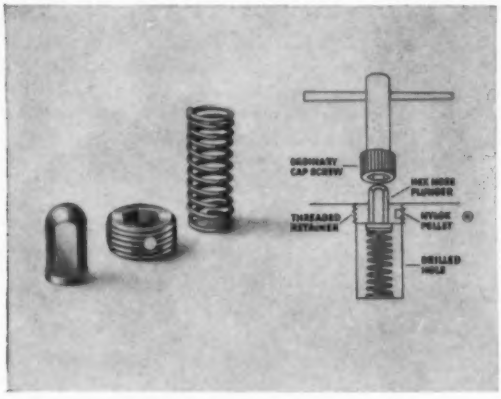
New uses are being found every day for Vlier Tooling Accessories. Perhaps the applications shown below will suggest ways you can profit by replacing costly, custom devices in jigs, dies and fixtures with precision, off-the-shelf Vlier products.



HEX NOSE SPEEDS INSTALLATION OF SPRING PLUNGERS—Vlier Hexnose Spring Plungers are easily installed with a simple end wrench. Eliminates hunting for special wrenches. Made to same exacting tolerances as Vlier Standard Spring Plungers. Available in many end pressures, diameters and lengths.



THIN-WALLED RING GEAR HELD SECURELY in fixture without distortion with 12 Vlier Torque Thumb Screws. Once pre-set end pressure is reached, knurled head spins freely, preventing overtightening. Checknut prevents backing off under vibration. Available in four types; various screw diameters and lengths.



NEW PLUNGER ASSEMBLY PREVENTS DAMAGE TO DIE STOPS—Plunger actuates automatic stop perfectly. Quickly installed, never needs adjustment. Hex nose mates with standard hex head bolts for easy insertion. Nylok® nylon pellet prevents threaded retainer from working loose. 6 sizes from ¼" to 1" diameter. Various end pressures.

FREE IDEA BOOKLET—Illustrations in this 16-page booklet show how others have profited from the use of Vlier Tooling Accessories. Shows both the usual and unusual applications. May suggest ways *you* can save. Write for your copy today.

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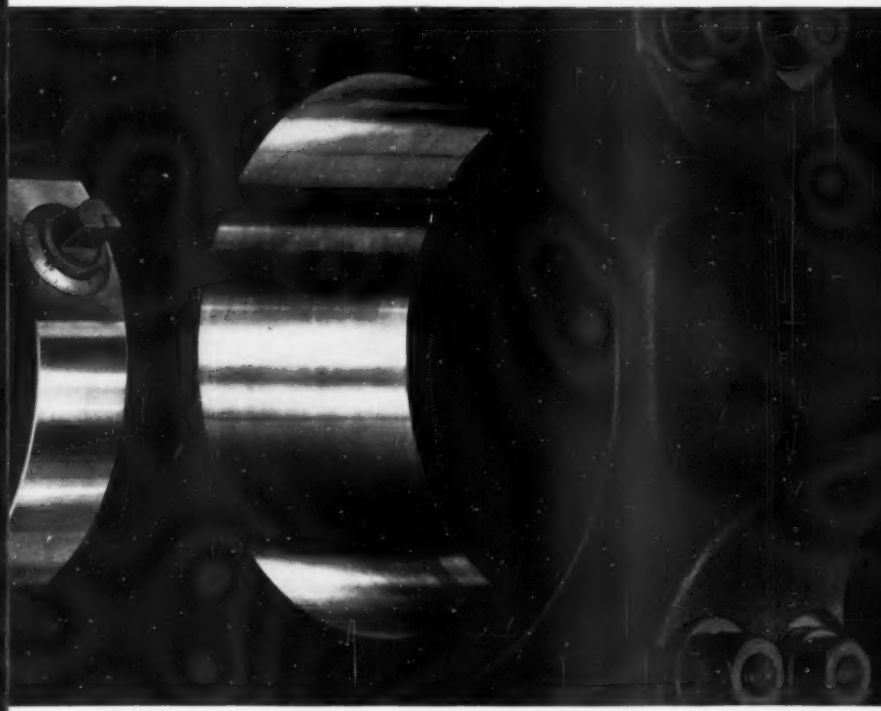
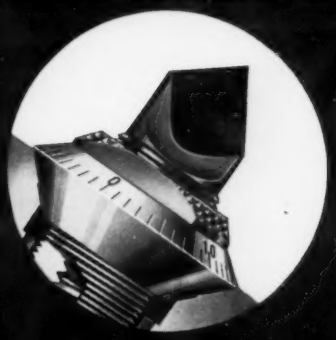
titanium carbide and ceramic tipped microbore adjustable tooling!



Minimum overhang between cutting tip and cone seat assembly reduces deflection, assures extended tool life.



Cone relief has uniform clearance around profile of cutting edge for maximum tool life.

Cone Relief Ground Like All Microbore Tips!

High cutting speeds! Microbore titanium carbide and ceramic tips cut at speeds and feeds impossible with any other type tips, yielding excellent surface finish . . . in some instances comparable to ground finish. Micrometer vernier adjustment sets the tool point in seconds to accurate part dimensions. Extreme rigidity of basic design, double cone bearing and axial locking force; plus minimum tool point overhang, makes Microbore ideal for these new cutting edges. *Like all Microbore cutting tools, the new tips are cone relief ground to gage room accuracy.* Microbore titanium carbide and ceramic tipped tooling are major developments in the complete Microbore system of precision cutting tools.

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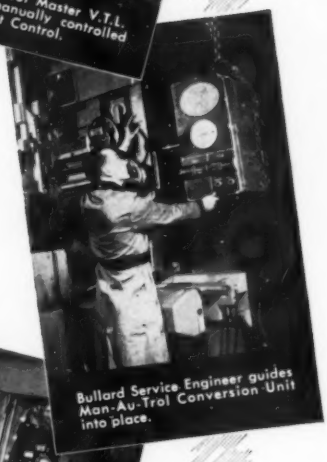
In May, 1955, Hyster Company, Peoria, Illinois, installed a 36" Cut Master V.T.L., Model 75 and by the end of 1956 it was evident that due to increased requirements an automatically controlled machine was necessary. *Did this obsolete the Cut Master?* — No sir — it only meant adding a Man-Au-Trol Conversion Unit to Cut Master *right in their plant. And it was accomplished in only four days.* No need to obsolete Bullard Cut Master, Model 75 — just convert them.

another way to cut costs when cutting metal — **buy BULLARD**

Man-Au-Trol installed for automatic control of Turret Head.

36" Bullard Cut Master V.T.L. Model 75 manually controlled from Pendant Control.



Bullard Service Engineer guides Man-Au-Trol Conversion Unit into place.

Electrical connections for Man-Au-Trol are wired into Cut Master Control Panel.

For the complete information on Bullard Vertical Lathes call our nearest Sales Office or Distributor.

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STARRETT SAFE-FLEX® HIGH SPEED STEEL BAND SAW

Here is a high speed steel band saw that cuts up to 10 times faster, lasts up to 30 times longer than ordinary blades. New heat treating techniques give it graduated hardness from super-hard teeth to super-tough, flexible back. New welding methods make the weld as strong as the parent metal.

Starrett Safe-Flex® High Speed Steel Band Saws have red heat hardness that permits using heavier feeds, higher speeds. They stay hard even at temperatures up to 1100°F. New tooth and gullet design, thinner section, plus sharp, precision cut teeth assure straight, accurate cutting, a fine finish, minimum metal removal. Recommended for all cut-off work on tool and die steels, ferrous alloys and hard-to-cut nonferrous metals . . . also for severing and slicing operations.

Your nearby Industrial Supply Distributor has Starrett Safe-Flex® High Speed Steel Band Saw Blades in regular, skip-tooth and hook-tooth types. He also stocks the complete Starrett line of hacksaws, hole saws, band saws and band knives. Call him for quality products, dependable service . . . or write for complete information. Address Dept. E, The L. S. Starrett Company, Athol, Massachusetts, U. S. A.

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The revolutionary P-K W-POINT Socket Set Screw is not only new—completely new—it is capable of delivering the highest degree of holding power ever attained... at no increase in price!

What's the difference between the new P-K W-Point and ordinary cup point set screws? It's the new pivot point that's built into the cup! This exclusive P-K feature reduces "wobble" caused by the required tolerance clearances between screw threads and the tapped hole . . . minimizes "tipping" motion imparted by key tightening . . . creates tracking which is uniformly even in depth and shape . . . results in frictional engagement of both cup edge flanks . . . provides:

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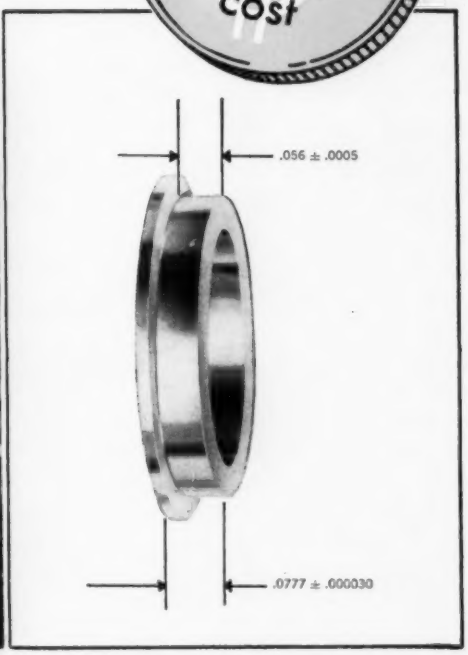
BURROUGHS PLANT REPORTS:

Norton No. 12 HYPROLAP* Machine

boosts production rate 1100% per hour . . .

saves time... reduces cost



In the Plymouth Division of the Burroughs Corporation at Plymouth, Michigan production men recognized the productive possibilities of this NORTON #12 HYPROLAP High Production Lapping Machine and now use it to finish spacer collars at over 11 times the speed of the two surface grinders previously used. Rotating carriers bring the collar between the upper and lower laps. Work pieces are automatically fed and ejected. Besides hitting a new high in production, Burroughs also has eliminated the grading and selecting of finished pieces through the extreme productive accuracy of this advanced NORTON lapping machine.

On the #12 HYPROLAP machine the upper lap refines the surface quality of the hub face of the spacer collar, holding the .056" dimension. The lower lap finishes the flange face, producing the .0777" thickness dimension within ±.000030" instead of ±.0001" as in the former method.

As proved in the Burroughs plant, the No. 12 HYPROLAP high production lapping machine offers many advantages over conventional finishing methods. Equipped with bonded abrasive laps, this parallel face flat lapping machine is available with automatic or semiautomatic continuous feed. Both arrangements provide fast lapping . . . continual operation with only occasional lap dressing . . . a wide range of selective speeds for laps and work holders . . . finished work washed clean, eliminating extra cleaning operations.

For further details on how this combination of speed and accuracy can improve your own finishing operations, see your Norton Representative or write us direct for Catalog No. 2359-1. And remember: only Norton offers you such long experience in both grinding machines and grinding wheels to bring you the "Touch of Gold" that helps you produce more at lower cost. NORTON COMPANY, Machine Division, Worcester 6, Massachusetts.

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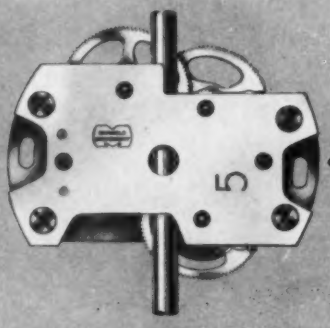

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You Will Probably Never Have to Repair or Replace It!

We say "probably" because it's likely that some MIRACLE MOVEMENT Indicators will meet up with such out-and-out abuse that their operation may ultimately be impaired. But, given the same hard shop usage as any other Dial Indicator, a MIRACLE MOVEMENT Indicator will outlast it many times over.

The MIRACLE MOVEMENT Indicator is not only wear-safe . . . it's also shock-safe. Contrary to what you might expect, no supplemental, "extra-price" devices need be added to the movement to obtain this protection. The MIRACLE MOVEMENT *itself* is shock-safe. So you get this protection automatically. You do not have to specify it . . . you do not pay extra to get it. Every MIRACLE MOVEMENT Indicator has it.

Nor do you have to specify MIRACLE MOVEMENT in order to get the finest Indicator of them all. From now on, *all* Federal Dial Indicators, except Super-Sensitive and Special Movement Models, will have the MIRACLE MOVEMENT. So, to have all these important features . . . all you have to do is specify Federal.

And, as you might expect, your present Federal Dial Indicator can be converted easily because the MIRACLE MOVEMENT is also available separately as a replacement unit, either Full-Jeweled or Plain Bearing. It fits into a current Model Indicator case without any changes. **You owe it to better, longer lasting accuracy and to drastically reduced Indicator maintenance costs to standardize on Federal MIRACLE MOVEMENT Indicators.**

. . . certainly the finest of them all.

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Precision Ground
SOLID CARBIDE
TOOLS AND BURS

Job Applications

NEW ATRAX DIA-MO CUT IMPROVES BUR PERFORMANCE ON STAINLESS AND HEAT TREATED ALLOYS

A new type of cut that produces a tooth form with three cutting edges on each tooth has many advantages over conventional Diamond Cut burs.

EXCLUSIVE ATRAX DESIGN

By carefully controlling depth of flute, both left and right, and by engineering a definite ratio between the number of left and right flutes, a revolutionary bur cutting action results.

3 CUTTING EDGES

The chisel shaped tooth with three cutting edges produces a flake-like chip instead of the hard-to-control sliver-like chips produced by cuts ordinarily supplied on burs and the gritty, abrasive chips formed with the pyramidal type tooth on most Diamond Cut burs.

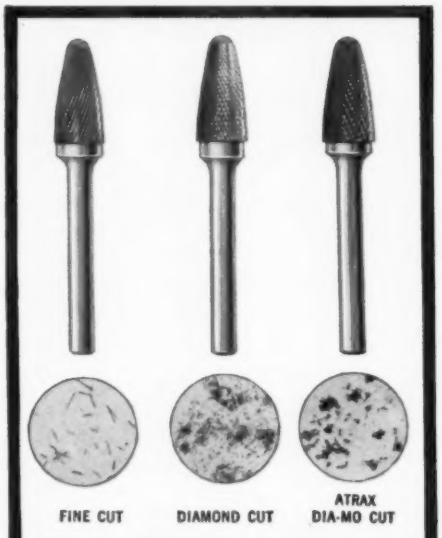
NOTE three cutting edges take shearing-type cuts producing smooth surface finish.

SUPERIOR TO DIAMOND CUT

Instead of the wearing grinding action of Diamond Cut burs, the new Atrax Dia-Mo Cut actually cuts small chips similar to those produced by peripheral end milling.

LONGER TOOL LIFE

Cutting action is faster and more positive and tool life is appreciably longer. This new type of cut has been shop tested and is recommended for cutting the toughest heat treated alloys and stainless steels. With the Dia-Mo Cut, "Bur-climb" is practically eliminated.



Fine Cut bur (left) produces long sliver-like chips. Diamond Cut bur (center) produces sharp, abrasive chips. Atrax Dia-Mo Cut (right) produces flake-like chips—gives faster, smoother cutting action.

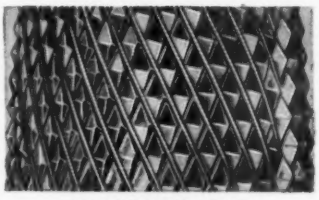
FASTER PRODUCTION

In extensive shop tests, increased burring production is possible because of faster stock removal and reduced operator fatigue.

DIRECTION OF CUT

DIA-MO CUT

DIRECTION OF CUT



DIAMOND CUT

IMPROVED SURFACE FINISH

Surface finish after burring with the new Atrax Dia-Mo Cut is superior to that produced by a Diamond Cut bur making subsequent finishing, grinding and polishing operations much easier.

It is recommended that the new Dia-Mo Cut be operated at 1/3 to 1/2 the speed of conventional burs for most efficient cutting action and uniform surfaces.

The new Atrax Dia-Mo Cut is available on request on 615 different bur sizes and types in standard, fine and coarse cuts.

We feel that this information can help you improve production, lower costs and discover the superiority of Atrax Solid Carbide Tools and Burs.

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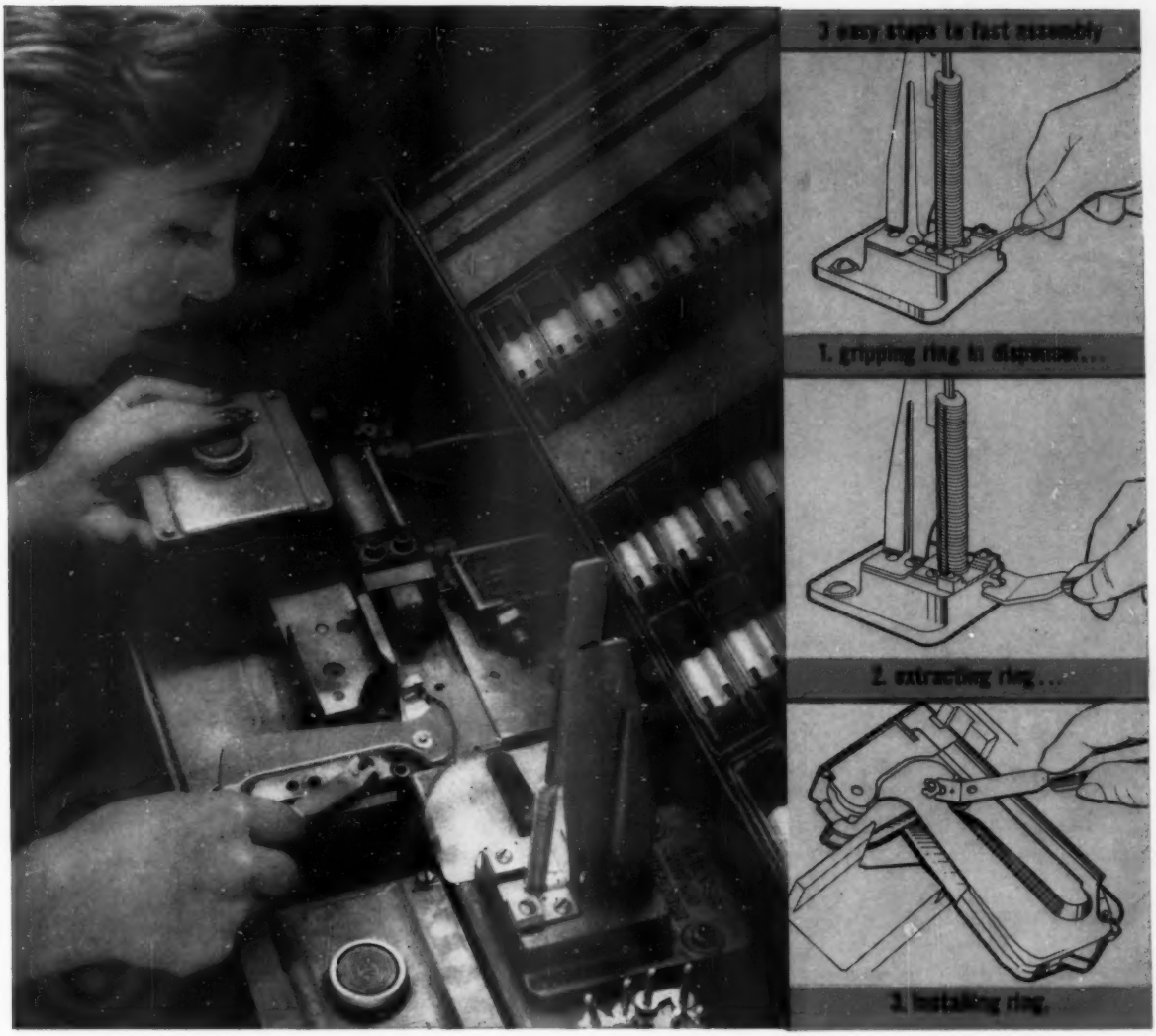

Truarc rings and dispenser speed staple gun assembly 60%

This big production increase was made by Swingline, Inc., Long Island City, N. Y. in assembling the handle lock of their high-compression staple gun.

To speed production, the Truarc Prong-Lock® Series 5139 retaining rings come *pre-stacked* for use on the Truarc *dispenser* (shown in foreground of photo above). Application is simple, fast and requires no skill. The operator, using the Truarc *applicator*, grasps the bottom ring, removes it from the stack, and installs it, quickly and easily, in the staple gun assembly.

The Truarc ring replaced an ordinary flat "C" washer, previously used in this application. *While the unit cost of the washer was lower than that of the Truarc retaining ring, the use of the rings resulted in assembled cost savings of $25.00 per thousand staple guns.* The reasons: a 60% increase in production due to faster, easier assembly with Truarc tools, and the elimination of time-consuming, costly adjustments made possible by Truarc rings. What's more, the bowed Prong-Lock ring improved product design by providing resilient end-play take-up . . . eliminating looseness or binding in the parts.

Truarc retaining rings come in 50 functionally different types . . . as many as 97 different sizes within a type . . . 6 metal specifications and 13 finishes. Truarc assembly tools, pliers, applicators, dispensers and grooving tools are available to speed production of virtually every kind of product. Make sure you have on file the new 16-page Waldes Truarc Assembly Tool Catalog No. AT 10-58. Write for your copy today. And remember Waldes engineers are always ready to help you solve your special application problems. Waldes Kohinoor Inc., 47-16 Austel Place, Long Island City 1, N. Y.

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RETAINING RINGS

Waldes Kohinoor Inc., Long Island City 1, N. Y.

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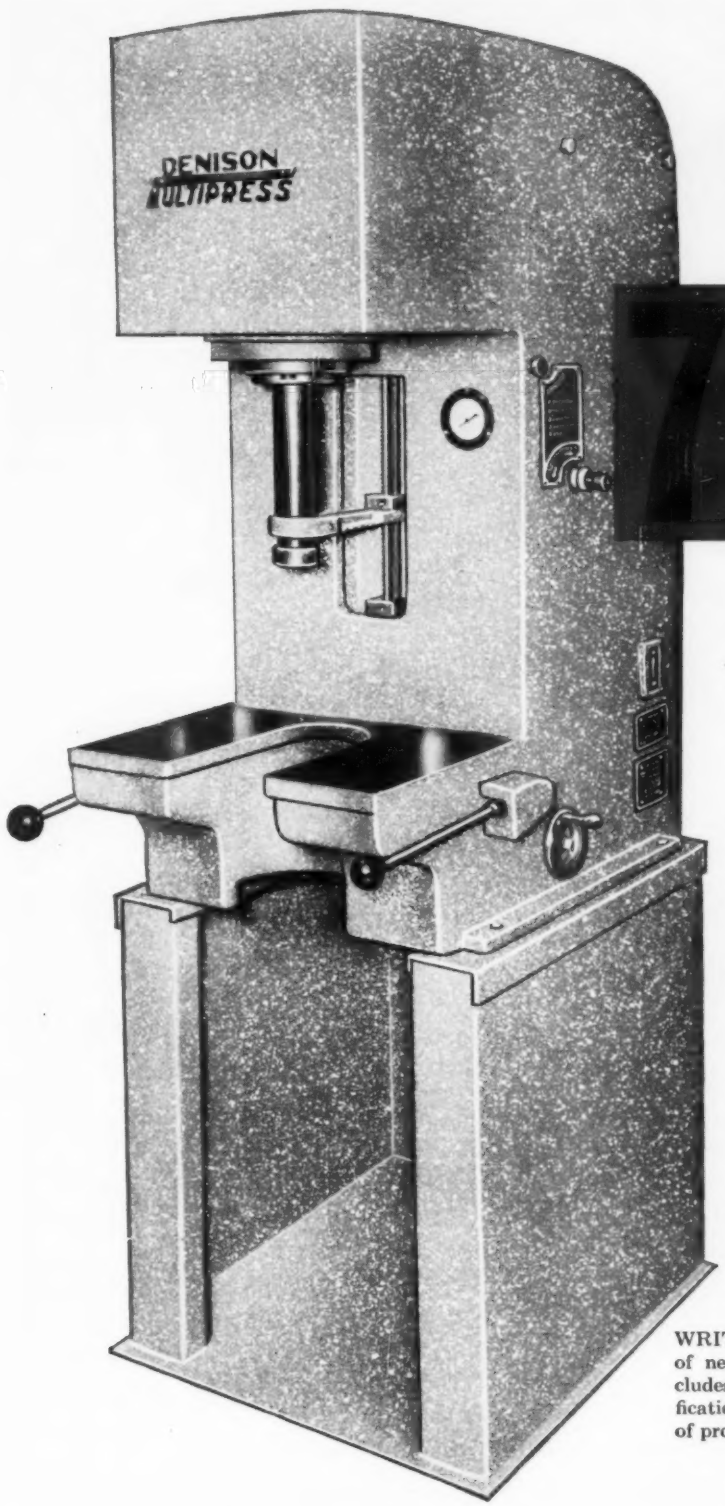

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EASIER TO OPERATE . . . there's more knee room for operator's convenience.

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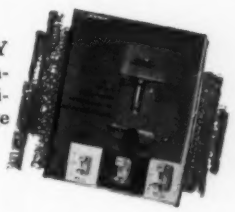
WRITE FOR YOUR COPY of new Bulletin 324 . . . includes application and specification data on wide range of production jobs.



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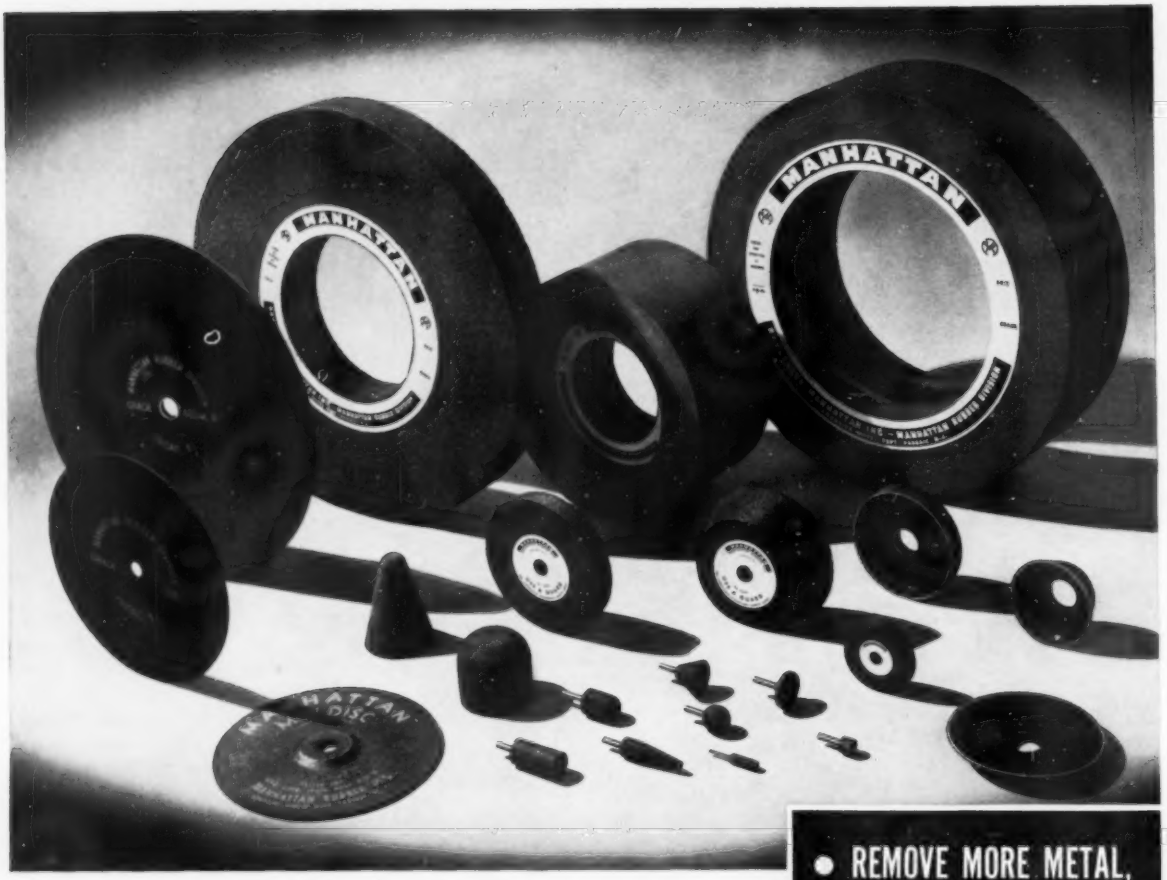

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Whatever your metal removal needs, a Manhattan Abrasive Wheel can be engineered for your particular alloy requirements. Manhattan abrasive wheel specialists help solve problems at *your* plant . . . for cutting, rough grinding, and finishing steels, light metals and alloys. Every component of the wheel you specify—abrasive, grain size, hardness, structure and bond—is custom-designed to give you more output per man hour . . . more production for your abrasive wheel dollar.

Discuss your metal removal or cut-off requirements with a Manhattan Abrasive Wheel Specialist. He'll show you how to boost production, reduce costs, and help you determine the best Manhattan high speed, heavy duty abrasive wheels for your operations.

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- CUSTOM-BONDED FOR YOUR JOB
- CUTTING, GRINDING AND FINISHING TYPES
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RING THREAD GAGES and INTERNAL MICROMETERS

Selection of taps and gages on the basis of the lowest initial cost often results in the highest production cost . . . a fact that is known by every "thinking man" on this important panel.

They know they can save time and money with fewer rejects due to the uniform accuracy of the BATH line of standard and special cutting tools . . . and gages!

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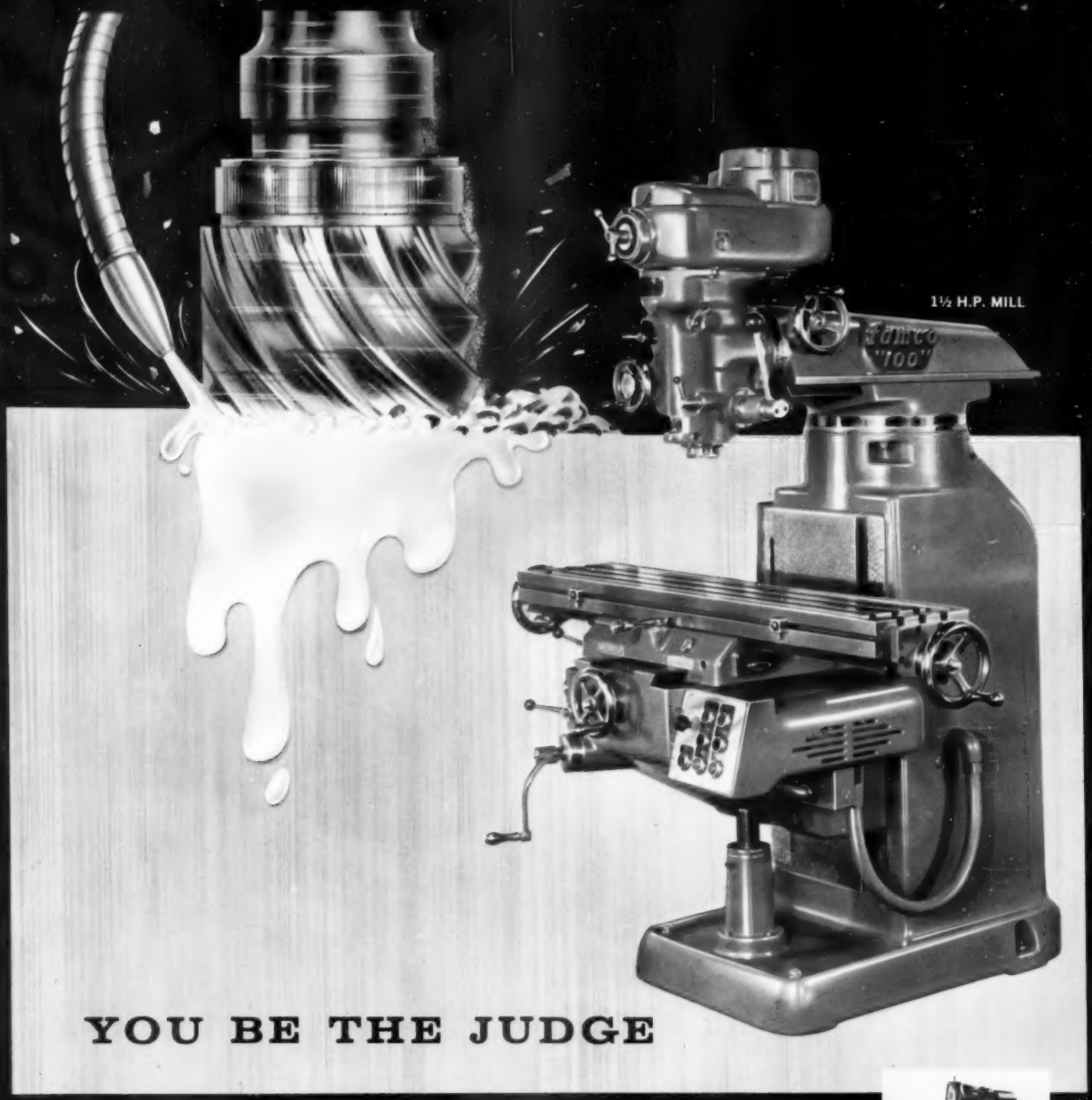
USE READER SERVICE CARD, CIRCLE 25 USE READER SERVICE CARD, CIRCLE 26



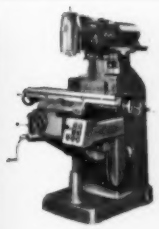
1½ H.P. MILL

YOU BE THE JUDGE

Some of our customers are hardboiled characters who cut their teeth on blue chips and were weaned on cutting oil. No kidding, they are really down to earth. Yet they have told us that the Famco mill is the finest mill they have ever used.

Naturally, they have an easy time convincing us. We build them. But how can you be convinced?

We would like your opinion! Write for the brochure describing these machines or ask for the address of your nearest dealer. We'll be happy to oblige. In that way, you can judge Famco's milling machine superiority for yourself.



2 H.P. MILL

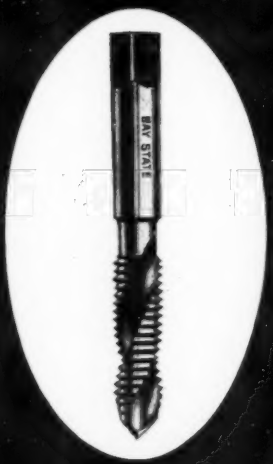
TRACER MILL

FAMCO MACHINE COMPANY KENOSHA 1, WISCONSIN

Manufacturers of:
Milling Machines, Presses • Air, Arbor, Power, Foot • Squaring Shears, Band Saws.

WHAT'S IN THIS TAP

IDENTIFICATION FOR YOU?



The Marking Is Conventional . . .
With The Exception
of BAY STATE

By using this standard BAY STATE tap with right hand, spiral flute for blind hole tapping in stringy material, you are assured of good chip removal. The result . . . another perfect thread at low cost . . . another precision performance by BAY STATE.

As tapping specialists, BAY STATE sales engineers will provide complete application engineering on any tapping problem. Off-the-shelf delivery is assured by new factory stockrooms and alert distributors.

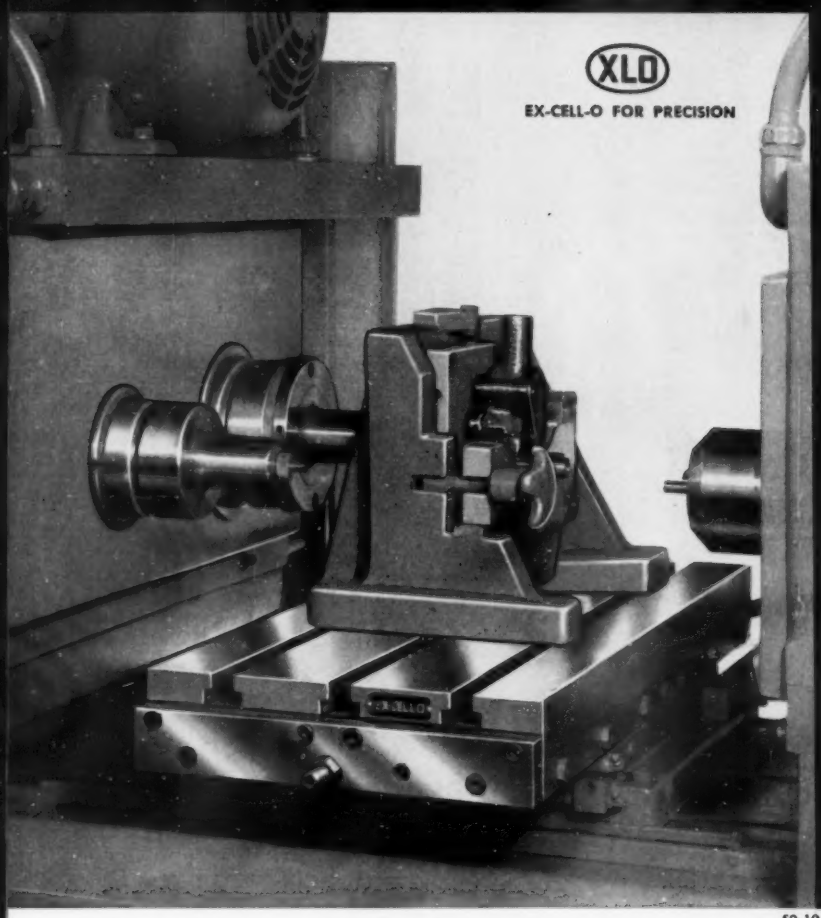
For full information on spiral fluted taps, see page 17 of BAY STATE Catalog 56.

BAY STATE TAPS

Bay State Tap & Die Company • Mansfield, Massachusetts

On the nearby shelves of your Industrial Supply Distributor.

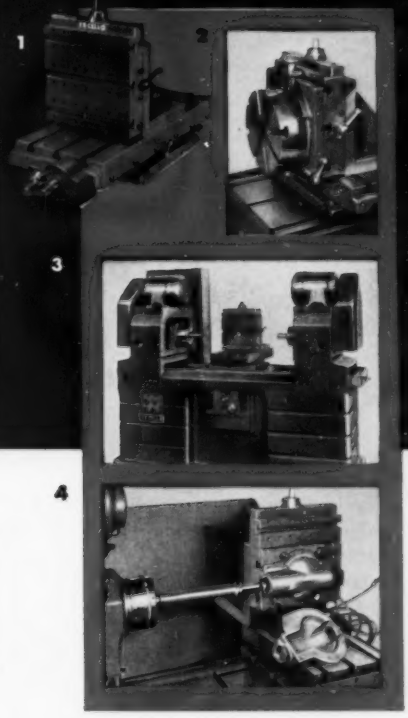
Add production flexibility the low-cost way, with EX-CELL-O UNIVERSAL FIXTURES



- Faster parts changeover
- Easier work setups
- More work from your present machines

LEFT
Hydraulically-operated cross slide of Universal Fixture supports angle plate fixture for production boring and facing.

BELOW
1 Manually-operated unit equipped with vertical slide. 2 Rotary Index Table mounts on Universal Fixture, has vernier scale for precise angular settings. 3 Installed on Style 17-A Precision Boring Machine, Hydraulic Universal Fixture increases versatility at low cost. 4 Adaptable to many operations, this Universal Fixture permits fast setup for line-boring and finish-facing work.



59-19

There's no end to the variety of boring, turning and facing jobs your Ex-Cell-O Precision Boring Machines can do when fitted with Universal Fixtures!

Designed for both short-run work and volume production, Ex-Cell-O Universal Fixtures come to you ready to mount on the machine table. Base, bracket and slides are normalized nickel-iron castings, with precision-machined T-slots and tapped holes for quick setup and accurate alignment of spindle to fixture. Work, fixtures or tools can be mounted at any position on the vertical or horizontal slide; inbuilt micrometer adjustment assures accurate setups.

Available for either manual or hydraulic operation, Universal Fixtures fit small and large Ex-Cell-O Precision Boring Machines, single or double-end models. Write today for details, or contact your Ex-Cell-O Representative.

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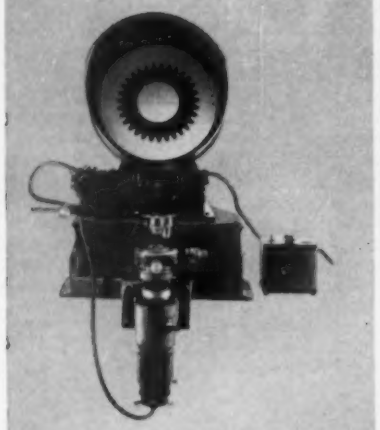
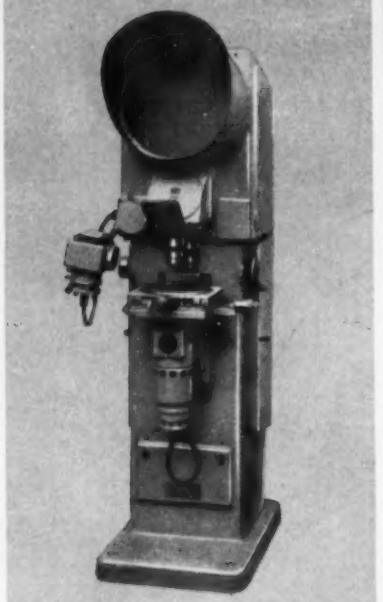
EX-CELL-O CORPORATION
DETROIT 32, MICHIGAN
Machinery Division

EX-CELL-O PRECISION PRODUCTS INCLUDE: MACHINE TOOLS • GRINDING AND BORING SPINDLES • CUTTING TOOLS • RAILROAD PINS AND BUSHINGS • DRILL JIG BUSHINGS • TORQUE ACTUATORS • THREAD AND GROOVE GAGES • GRANITE SURFACE PLATES • AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • DAIRY EQUIPMENT

NIKON OPTICAL COMPARATORS



Model II Portable Bench Unit



Model III Floor Unit

Model VI Bench Unit

3 models for accurate inspection of precision parts

Whatever your inspection needs – whatever your budget considerations – there's a Nikon Optical Comparator to meet the demands of both. For Nikon has successfully fulfilled the two most pressing requirements in industry – *outstanding performance at moderate cost.*

Whichever of these three models you select, you will discover the same demonstrable qualities in each: bright screen illumination, sharp edge-to-edge definition, ease and speed of operation, and an almost unlimited versatility. You will be especially impressed with the high accuracy of performance, the simplicity of mechanical design, and the ruggedness of construction.

Nikon comparators may be used for surface as well as contour inspections – simultaneously, if desired. The inherent versatility of the Nikon is even further extended by the availability of a wide assortment of accessories for general and special applications: lenses covering a wide range of magnifications – 8 different stages – goniometers – fixtures – charts – vernier protractor screens – and photo-recording equipment.

NIKON Model II Portable Bench Unit –

Ready portability is one of its major advantages. It can be easily carried from one part of the plant to another for accurate on-the-spot inspections and measurements – with minimum loss of down time. Equipped with 3-lens turret.

NIKON Model VI Bench Unit –

Offers many advanced features: hand-wheel control for fine focusing, built-in illuminator for surface inspection, built-in blower system, bayonet mount for rapid lens interchangeability. Also available with bayonet, 3-lens turret.

NIKON Model III Floor Unit –

A rugged unit of extreme efficiency and accuracy – completely self-contained in cast aluminum housing. Fine movement focusing system employs lead-screw drive with scraped ways and adjustable gibs. Equipped with 3-lens turret.

For illustrated catalog, complete specifications and prices of all units and accessories, write to: Dept. TE-11.

NIPPON KOGAKU TOKYO **NIKON INCORPORATED** • 111 Fifth Avenue, New York 3, N. Y.

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USE READER SERVICE CARD, CIRCLE 30

ONE HOLE FREE IN EVERY THREE

Because the new SPEEDICUT "CHIPBREAKER"® operates at 50% to 400% higher feed rates, it drills at least three holes in the same time ordinarily required for only two with even the finest general purpose or heavy duty drill. And more holes per regrind means less down time and further savings in production costs.

See a demonstration in your own plant on your own equipment and type of work. Your local authorized SPEEDICUT "CHIPBREAKER" distributor will gladly arrange it. Write for literature and name of distributor.

THE PATENTED RIB
that cannot be duplicated

SPECIFY
SPEEDICUT "CHIPBREAKER"
SPEED WITH SAFETY

SPEEDICUT DIVISION. CHICAGO HEIGHTS STEEL CO. • CHICAGO HEIGHTS, ILL.

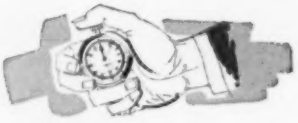
NEW GARDNER-DENVER TRU-THREAD TAPPERS

Tru-Thread Tapper with mounting bracket for stationary applications.

Tru-Thread Tapper with nosepiece for portable applications.

...CUT COSTS IN PRODUCTION TAPPING

TIME TO TALK COST SAVING



When you keep in touch with your Gardner-Denver air tool specialist, you keep in touch with the latest developments in new methods and machines to cut production costs. This is the foundation of our 100-year philosophy of growth—at Gardner-Denver there's no substitute for men.

Quality performance

Now precision tapping of clean, accurate threads is quick, easy and economical with new Gardner-Denver air-powered, positive-feed Tru-Thread (T.M.) Tappers. "Controlled-pitch" lead screw feed prevents tearing or stripping of threads and tap breakage. With Gardner-Denver "controlled pitch," Model 93B Series tappers consistently produce threads of Class 3 fit quality. Single control starts completely automatic cycle.

Portable or stationary mounting

Mount the Tru-Thread Tapper on a simple jig or automatic machine and get low-cost, *precision* thread cutting. Keep your machine tools efficiently occupied with other work.

For portable applications, simply add a nosepiece for use with self-locking drill bushing tip. One man can easily take the tool to the work . . . from job to job.

Designed specifically for production thread cutting, the Tru-Thread Tapper is the ideal solution to all tapping problems in hole sizes from No. 2 to 1″ diameter. Ask a Gardner-Denver special machines engineer how this versatile air tool can be incorporated into a fully automated unit. For complete details, request Bulletin 93-31.

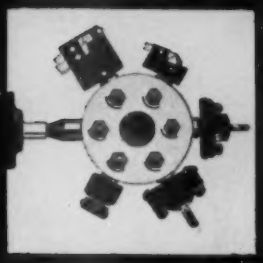
EQUIPMENT TODAY FOR THE CHALLENGE OF TOMORROW

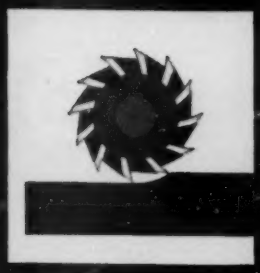
GARDNER-DENVER

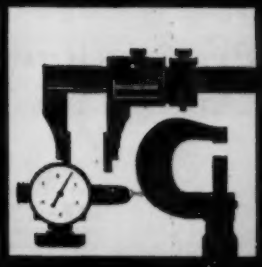
Gardner-Denver Company, Quincy, Illinois
In Canada: Gardner-Denver Company (Canada), Ltd., 14 Curity Avenue, Toronto 16, Ontario

Brown & Sharpe

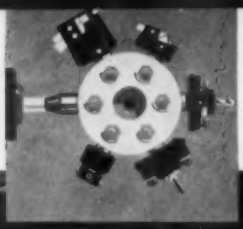
PRECISION CENTER







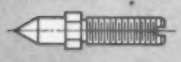
to help you
make more
for less . . .



TO HELP YOU REDUCE SCREW MACHINE PRODUCTION COSTS

Production records prove the new Brown & Sharpe Automatics pay off predicted savings - with a plus

B-1113 STEEL

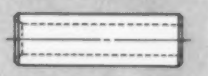


49% SAVING
in production time

With previous equipment	With new No. 2 Automatic
34⅓* Sec. per piece	17½

*Includes 22½ sec. for secondary operations which are now part of No. 2 Automatic machining cycle.

B-1113 STEEL



54% SAVING
in production time

With previous equipment	With new No. 2 Automatic
57⅛* Sec. per piece	22½

*Includes 2¼ sec. for secondary operation which is now part of No. 2 Automatic machining cycle.

Now, from plant after plant where the new B&S No. 2 Automatic Screw Machines are in the line, reports show that they not only deliver the promised advantage over old equipment, but often provide a substantial plus in extra savings. In many cases — one, two, and sometimes three secondary operations have been eliminated. The need for the extra machines is ended, and total man-hour savings run as high as 90%.

In addition, the new Automatics maintain specified tolerances as close as 0.0005", and meet the highest standards for surface quality.

With such proved production savings, buyers agree that the new Automatics "pay for themselves in record time." Find out how you can make comparable savings with the extra speed and precision — the extra adaptability for combined operations — the faster set-ups and extended tool life.

The No. 2 Automatic is made in 3 sizes — to take stock up to ¾", 1¼", and 1½" diameter. For complete details, write: Machine Tool Division, Brown & Sharpe Mfg. Co., Providence 1, Rhode Island.

Brown & Sharpe PRECISION CENTER

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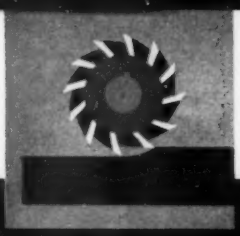
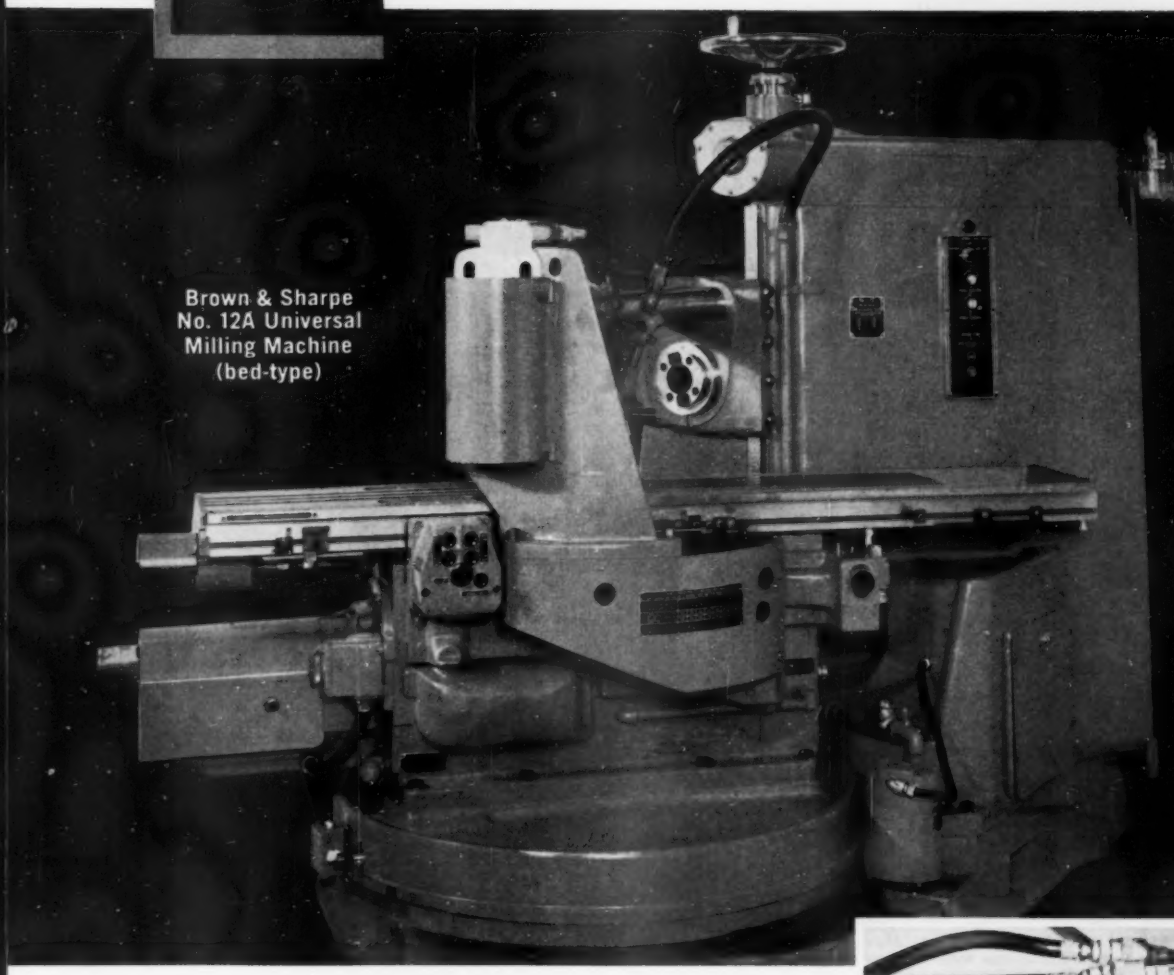


TO HELP YOU MILL MORE FOR LESS



Brown & Sharpe
No. 12A Universal
Milling Machine
(bed-type)

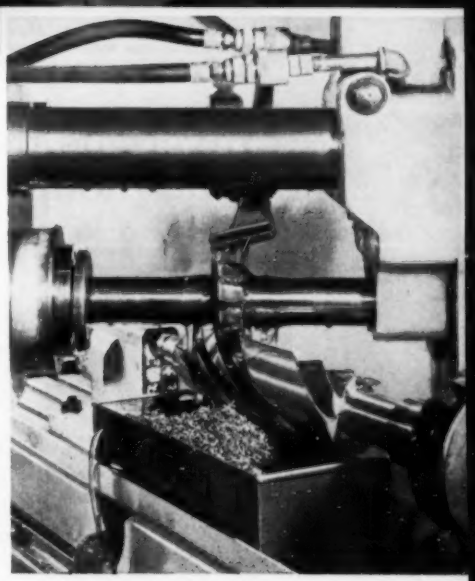
NOW—helical milling with automatic production economy

The No. 12A Universal combines a unique swiveling base arrangement with the powerful cutting ability and automatic control features of the popular Brown & Sharpe bed-type milling machines. Developed for helical milling of cutters, drills, reamers, and similar work, it provides big savings in production costs over knee-type Universals designed for small-lot operations.

Control operations are automatic, freeing operator for other duties after work piece has been loaded and machine started. Automatic operations include separation of cutter and work to provide necessary clearance required for the run back in helical milling.

Cutting feeds more than double those practical on knee-type machines have been used for work transferred to the No. 12A, and surface quality improved. The rugged bed-type construction and full bearing support of the table ways, and the rigid arbor support provide ideal conditions for the heaviest cutting loads.

For complete information on all the cost-saving advantages of the No. 12A Universal, write: Machine Tool Division, Brown & Sharpe Mfg. Co., Providence 1, Rhode Island.



Brown & Sharpe PRECISION CENTER

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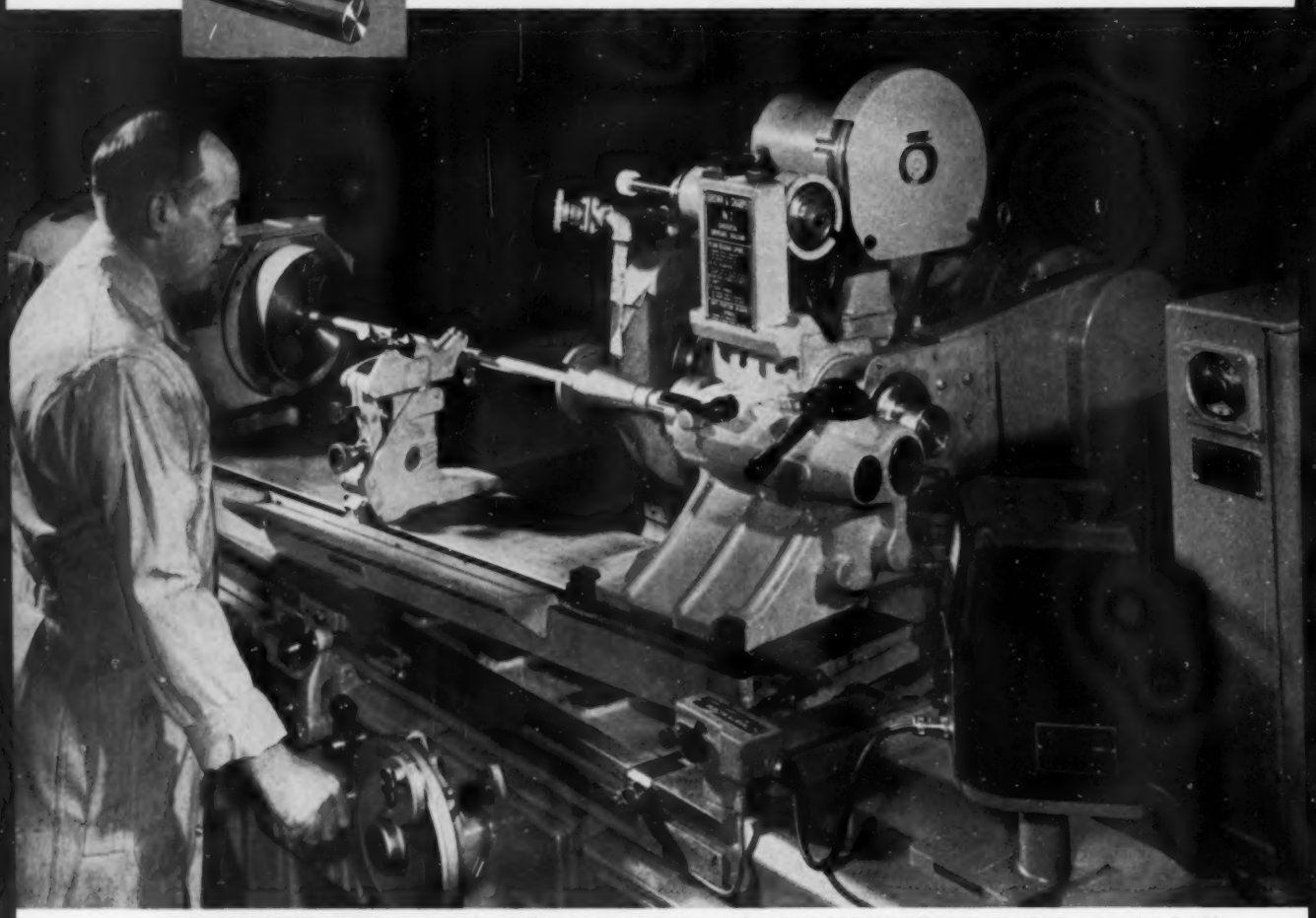
TO HELP YOU GRIND MORE FOR LESS



BROWN & SHARPE design for dependable grinding economy includes . . . Completely Universal Wheel Spindle Head on Turret — Set Diamond Wheel-truing Attachment for Internal Grinding — Power and Hand Cross Feed in Both Directions — Power Cross Feed Continuous to Finish Diameter Setting — Positive Stop for both Internal and External Grinding — ELECTRALIGN for Instant Table Alignment.

Universals that deliver more grinding minutes per man-hour - save up to 75% in floor-to-floor time

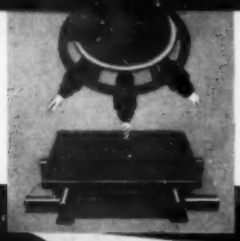
Brown & Sharpe Universal Grinding Machines provide many exclusive advantages that simplify the operator's task, save set-up time, and speed up non-grinding motions. Job time saved often totals 75% or more.

Only Brown & Sharpe offers the ELECTRALIGN®, the original electronic indicator for swivel table alignment — the only device that permits instant alignment to 10 millionths per inch of workpiece with a single setting. The operator is fully relieved of the need for calculations. No delay for repeated gaging and adjustment, and no scrap.

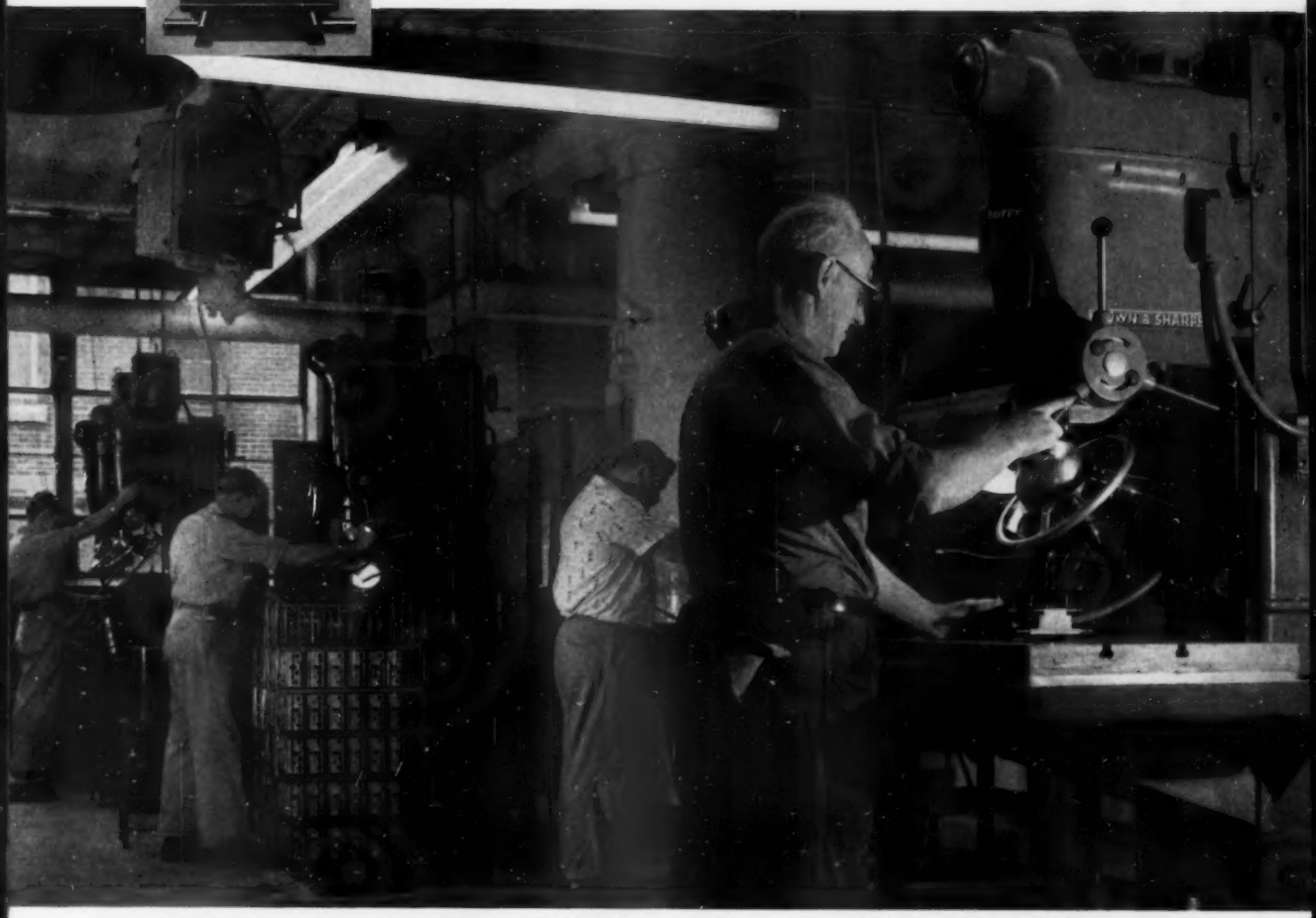
For top returns in cost-reduction, you need all the extra advantages of Brown & Sharpe design when you choose grinding machines for toolroom, prototype operations, or for production grinding. Why settle for less? Four machine sizes. For details, write: Machine Tool Division, Brown & Sharpe Mfg. Co., Providence 1, Rhode Island.

Brown & Sharpe PRECISION CENTER

USE READER SERVICE CARD, CIRCLE 35



TURRET DRILLING MACHINES... TO HELP YOU DRILL MORE FOR LESS



AT MINNEAPOLIS-HONEYWELL, BROWN INSTRUMENTS DIVISION, Philadelphia, six Model A B&S Turret Drilling Machines are used for a wide variety of drilling, tapping, boring, and reaming operations — permit 2 to 5 times faster production than with box-jig gang drill methods. In the typical part (below), the casting is cut away to show the 10-micro finish of the holes reamed at the top.

Reaming to 10-micro finish with carbide tooling on Brown & Sharpe Turret Drilling Machines

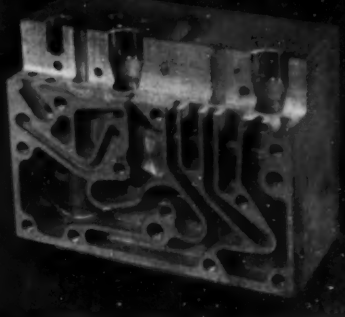
Machining complex die castings of No. 13 aluminum for a Minneapolis-Honeywell industrial process instrument was a "tool-killer" when the conventional method of box jigs on gang drill presses was used. For combination reaming of 2-diameter holes cored in the casting, a carbide reamer was tried, but the percentage of rejects remained high, and a tool-life of only 100 pieces made tool costs prohibitive.

The job was transferred to a Model A B&S Turret Drilling Machine equipped with a B&S Positioning Table and a simple work-holding device in place of the box jig. Using the same carbide reamer without guide bushings, rejects were virtually eliminated, a 10-micro finish was consistently maintained, and tool-life increased to over 500 pieces.

The B&S Turret Drilling method assures all conditions essential to successful use of carbide tooling — accurate work positioning, rigidity, proper spindle speed, easy chip removal, and ample coolant supply.

Find out how you can use Brown & Sharpe Turret Drilling to save handling time, set-up time, jig costs, capital investment, floor space and maintenance. Write for complete information. Brown & Sharpe Mfg. Co., Turret Drilling Machine Division, 20 Fitch St., East Norwalk, Conn.

5 TIMES LONGER TOOL LIFE



Brown & Sharpe PRECISION CENTER

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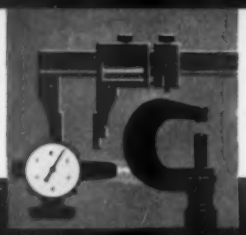
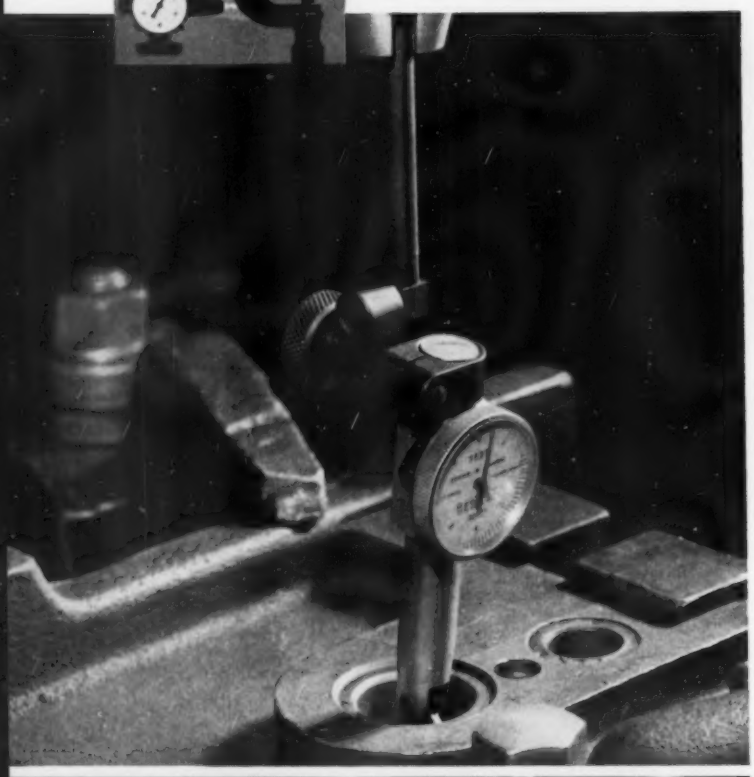


TO HELP YOU MAKE PRECISION MEASUREMENTS EASIER AND FASTER...



Precision Tool News

Compact new test indicator works in tight places, reads in .0001″

You can take measurements in *closer quarters* with Brown & Sharpe's little 7027 "Bestest" dial test indicator. Its 1 9/16″ long stem is only 3/8″ in diameter.

And you'll get more *accurate* measurements, too. The 7027 has a fully-jeweled movement; the dial reads directly in ten thousandths; it is extremely repetitive.

Other features: Small lever reverses contact point direction at a touch; new friction adjustment compensates for wear of point bearings; chrome finish throughout; easy-to-read dial.

The B&S 7027 Bestest Indicator is available with .040″, .080″ and .120″ contact points, plus accessories for use with all rigid-type B&S holding devices — or with .080″ point and one bar only (for 12″ Vernier Height Gages) — in a handsome hinged-cover wooden case.

New B&S Rotary Magnet Chucks are powerful enough for turning operations

Brown & Sharpe's new rotary permanent magnet chucks are so powerful that you can actually use them for substantial cuts on lathes, boring, and other metalworking machines. They have 25% to 75% greater holding power than previous types — are lighter and thinner — have circular rings that help centering, too. Available in 4¾″-, 6½″-, 9″-, and 12″- diameter sizes. They are also ideal for grinding operations.

B&S Black Granite Thrift Surface Plates available at new low cost

To get famous Brown & Sharpe Black Granite Surface Plates at lowest cost — choose from this no-ledge "Thrift" line. You get surface accuracy of 100 millionths, in a low-cost plate that will outwear metal and ordinary granite plates. Stock sizes from 12″ x 18″ to 48″ x 144″ — Specials to suit any need. (Brown & Sharpe recently furnished one special that measured 6′ x 16′ in one piece.)

Call your B&S Distributor!

He's *nearby* . . . He can make *prompt delivery* of B&S tools from local stocks . . . He's ready, willing and able to *help you*. Brown & Sharpe Mfg. Co., Providence 1, Rhode Island.

Brown & Sharpe PRECISION CENTER

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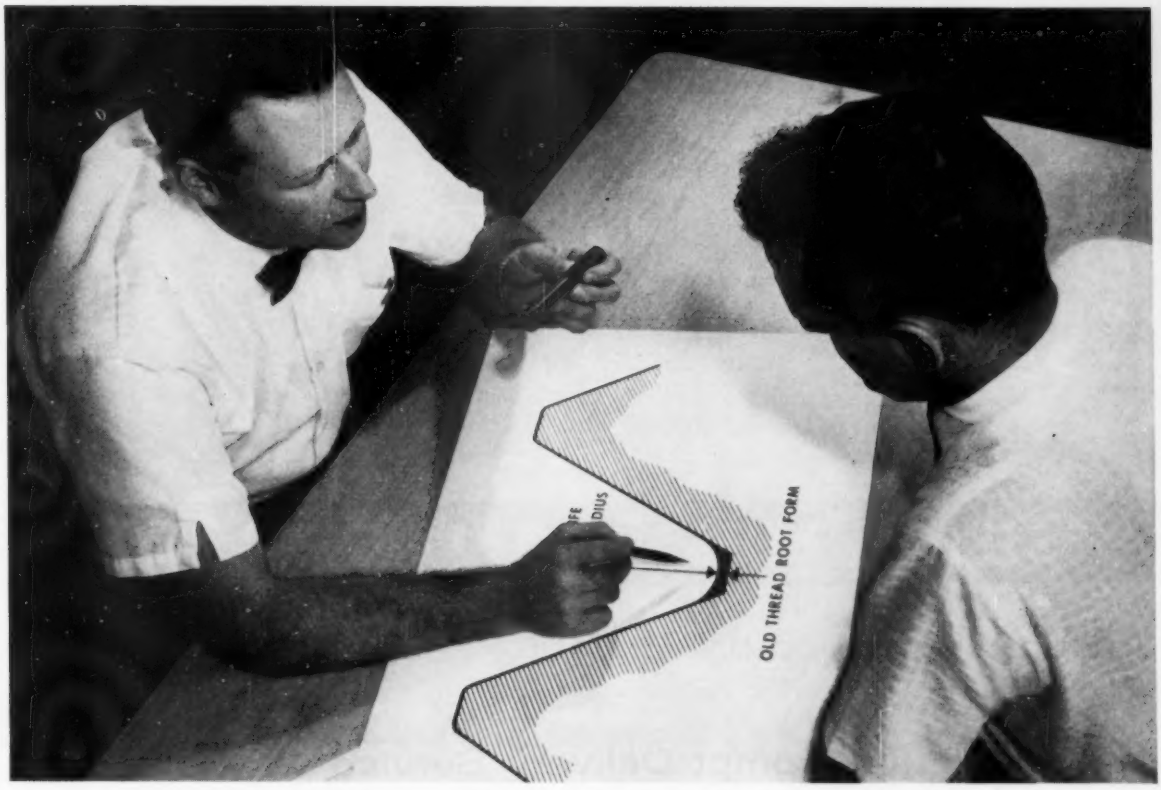
SPS RELIABILITY / *A dynamic standard of predictable performance*

The big change is in the threads



Extra strength for screw-fastened assemblies. New UNBRAKO Hi-Life thread form developed by SPS research features smoothly radiused contour, with more metal at root. New profile virtually doubles fatigue life, adds tensile strength. Hi-Life screws fit standard tapped holes, cost no more than former UNBRAKOs.

New thread form on UNBRAKO Hi-Life cap screws increases fatigue life up to 100% . . . gives your product added reliability at no extra cost.

For years the conventional thread root form for socket screws has been a truncated V with flat root. In the new UNBRAKO Hi-Life screws this is changed, the root being smoothly radiused from flank to flank. The result? A major reduction in stress concentrations at this critical point.

In terms of fastener performance, tests show the new UNBRAKO Hi-Life socket head cap screw gives you up to 100% more fatigue life than flat root screws. And you also get a bonus in tensile strength, because UNBRAKO Hi-Life has more metal at its minimum cross section. Both benefits are achieved without effect on gaging or ease of engagement.

New Hi-Life UNBRAKOs give your product added insurance against failures caused by dynamic stresses—particularly under field conditions where screws may not always be seated or tightened properly. And on the assembly line, their greater tensile strength permits higher preloading, which lengthens fastener fatigue life.

Your authorized SPS distributor has new UNBRAKO Hi-Life socket screws in stock now in sizes #4 through 1½ inch. See him for details, or write SPS—manufacturer of precision threaded industrial fasteners and allied products in many metals, including titanium. Request new Bulletin 2577.

TENSION-TENSION FATIGUE TESTS

½-20 Socket Head Cap Screws

Testing Speed: 1050 CPM	Average Fatigue Cycle Life	
Alternating Stress (psi)	Old Thread Root Form	UNBRAKO Hi-Life Thread
7,000 to 70,000	22,900	40,000
5,000 to 50,000	56,650	89,950
4,000 to 40,000	120,700	232,350
3,000 to 30,000	598,000	1,808,000
2,000 to 20,000	2,076,000	8,000,000*

*Test stopped—no failure

Tests run on ½-20 Hi-Life socket head cap screws show an increase of up to 100% in fatigue life over old-style screws with flat root. Radiused root of UNBRAKO Hi-Life thread reduces stress concentration at point where majority of fatigue breaks occur.

INDUSTRIAL FASTENER Division SPS

JENKINTOWN 37, PENNSYLVANIA

TOOL ENGINEERS:

SEE THIS MAN for:

Accurate and Durable Collets, Feed Fingers and Pads
with
Prompt Delivery Service
and
Attractive Prices

One Source of Supply Means Purchasing Economy

Order From **HARDINGE** Today

COLLETS—FEED FINGERS—PADS

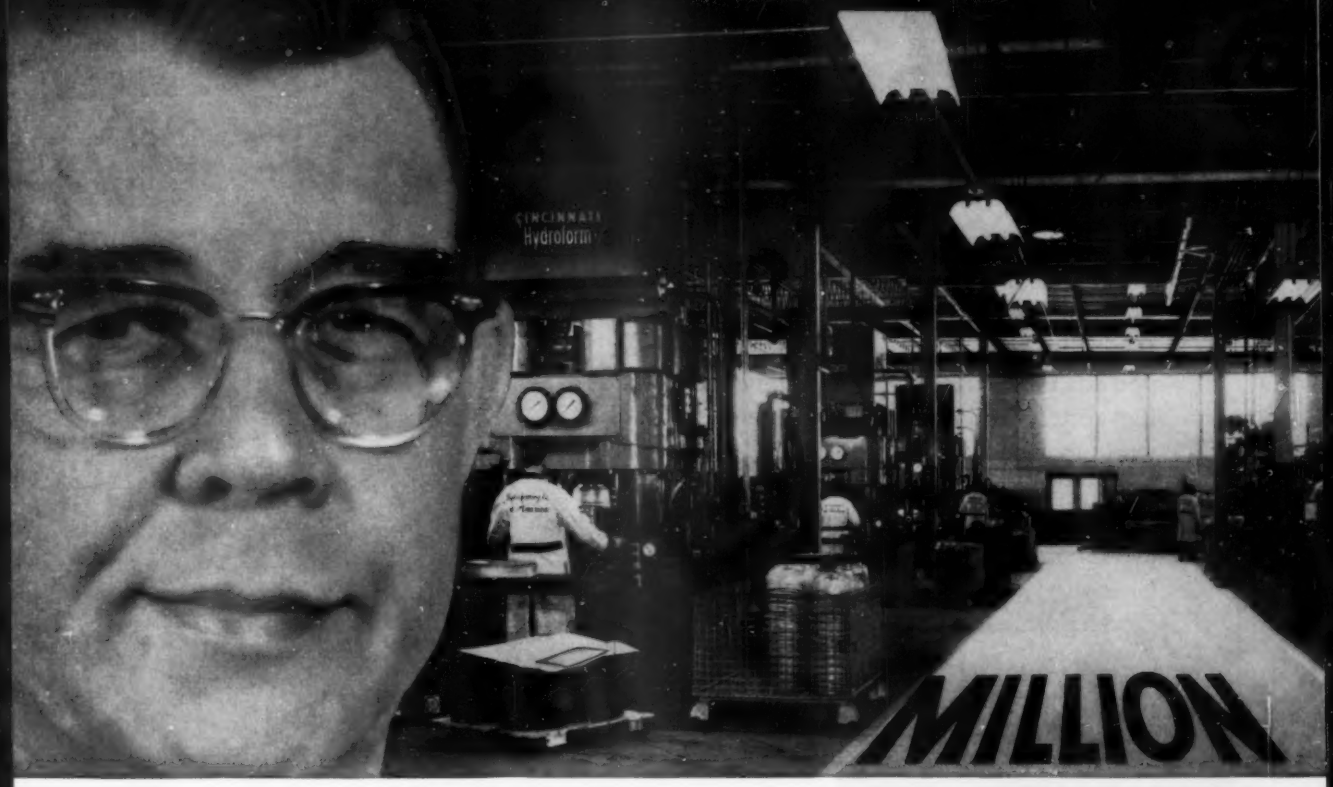
FOR: Brown & Sharpe, Cleveland, Cone, Davenport, Greenlee, Acme Gridley, National Acme, New Britain, Warner & Swasey, Jones and Lamson, Gisholt, Bardons & Oliver, Foster, Morey, Simmons, Ames, Atlas, Cushman, Hendey, LeBlond, Pratt & Whitney, Monarch, Bridgeport, South Bend, Kearney & Trecker, Linley, Van Norman, and others.

Ask for FREE Catalog

All Types Collets, Feed Fingers and Pads Carried in Stock at Elmira, Boston, Atlanta, New York, Hartford, Philadelphia, Dayton, Detroit, Minneapolis, Chicago, St. Louis, Oakland, Portland, Seattle, Los Angeles, Toronto

For the savings in tool costs made by Hydroforming

Col. Herman E. Lacy calls this his



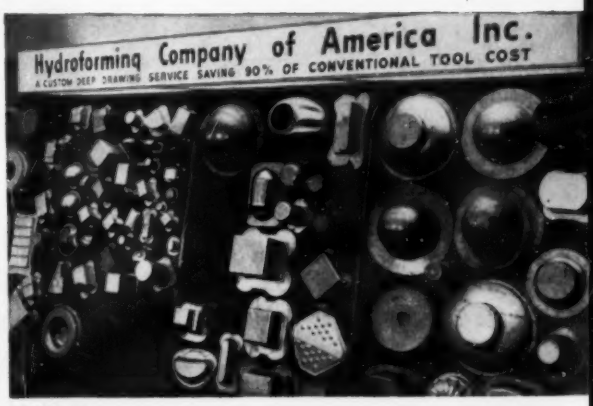
MILLION DOLLAR AISLE"

Col. H. E. Lacy is owner of Hydroforming Company of America, Inc., Chicago. As one of the nation's leading suppliers of custom Hydroformed parts, he is exceptionally well qualified to talk on tool cost savings. "The unique Hydroform technique," says Col. Lacy, "has saved our customers *millions of dollars of tool costs.* Further, Hydroforming combines extreme precision in deep drawing, with versatility that gives designers unequalled freedom. Better drawn parts, in fewer operations, at lower costs, can be yours by Hydroforming."

The photo above shows five Cincinnati Hydroform® machines in operation at this custom deep drawing shop—an 8″, a 12″, two 19″ and a 23″ size machine. The company's capacity for producing larger Hydroformed parts will soon be increased by the addition of a Cincinnati 32″ Hydroform.

To determine if Cincinnati Hydroform machines can produce savings for your manufacturing program, call in a Meta-Dynamics Division field engineer.

META-DYNAMICS DIVISION
Machines for Metal Forming and Heat Treating
THE CINCINNATI MILLING MACHINE CO.
Cincinnati 9, Ohio, U.S.A.
CINCINNATI

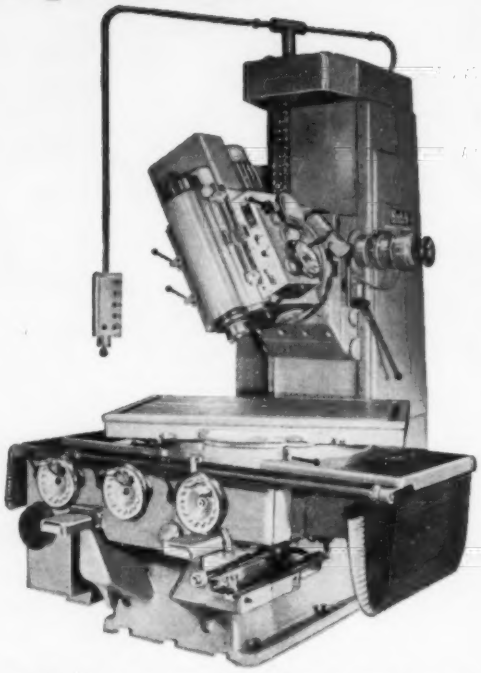


This photo of a display panel at Hydroforming Company of America, Inc., shows the wide range of Hydroformed part size, gage and complexity of shape produced by this firm.

USE READER SERVICE CARD, CIRCLE 40

Avoid Double Handling of Large, Heavy Workpieces

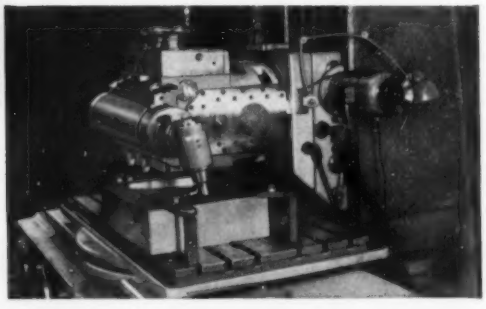
with a BOKOE F3 Universal Miller



Save costly set-up time and avoid transferring bulky workpieces from one machine to another —with the BOKOE F3 Universal Milling and Boring Machine. On one, versatile machine you can now perform boring, milling and drilling—often on 5 sides—without re-setting the workpiece. The remarkably flexible operation of the BOKOE F3 is especially suited for the machining of ferrous and non-ferrous castings, dies, molds, and metal and wooden patterns. Check these many BOKOE features for *your* production needs . . .

Rotary milling on large component.

- Coordinate positioning of rotary worktable with steplessly adjustable feeds for transverse, longitudinal and rotary movements—operating either individually or simultaneously. Rapid travel for all three directions.
- Clamping area up to 63″ x 31.5″. Longitudinal movement up to 72″, transverse movement up to 28″. Maximum workpiece diameter for circular and radius milling, up to 98″. Maximum distance, main spindle to column, 48″.
- Stepless spindle speeds from 36—1800 rpm. Six spindle feeds from .0016 to .016 in./revolution. Spindle slide rotates 90° in either direction. Entire column rotates 360°.
- All electrical equipment in accordance with J.I.C. standards.



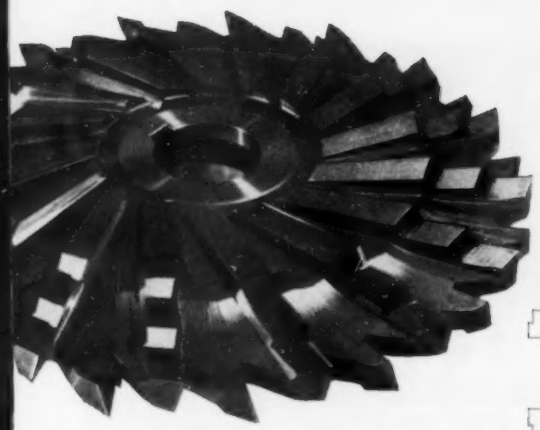
Head turned 90° with right-angle milling attachment.

Write For Information

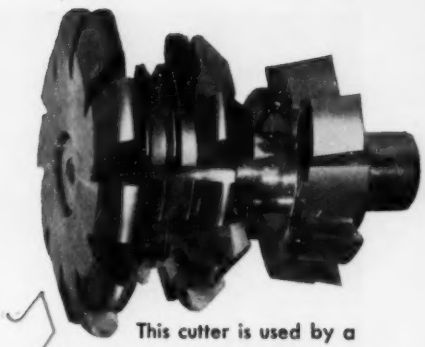
COSA — *nationwide sales and service of precision machine tools —from bench lathes to boring mills.*

COSA CORPORATION, 405 LEXINGTON AVENUE, NEW YORK 17, N.Y.

IN CANADA—COSA CORPORATION OF CANADA LTD., 1160 Lakeshore Road, Long Branch, Toronto 14, Ontario



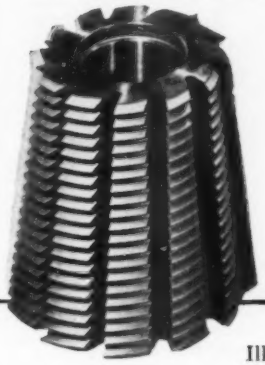
A special multiple-step milling cutter used by steam turbine manufacturer to cut stepped rotor slots for turbine blades.

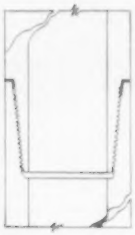


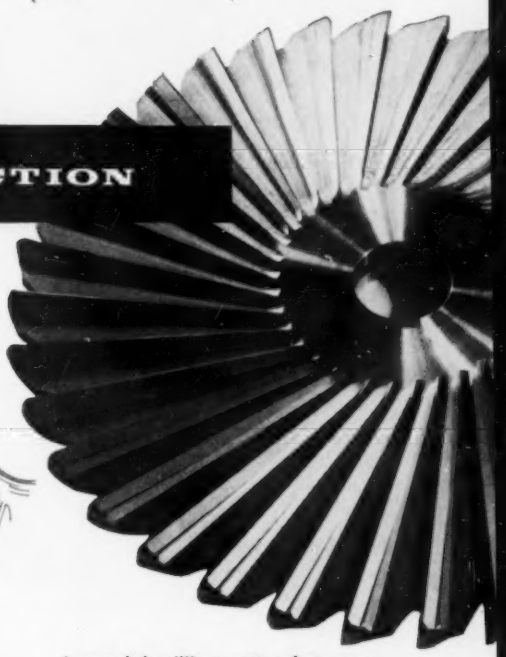
This cutter is used by a prominent saw manufacturer to form mill the profile in dado blade sets for the wood working industry.

HOW TO GET THE MOST OUT OF HIGH SPEED PRODUCTION MILLING MACHINES

This tapered multiple thread mill cuts threads in pipe joints used in oil well drilling operations.







A special milling cutter for sweep milling impellers used in air conditioning and jet engine sections.

Illinite® Special Milling Cutters, like those shown here, speed production and cut costs two ways:

(a) Illinois Tool applied metallurgy assures long, efficient tool life through proper material selection, forging and heat treatment *tailored to your specific application.*

(b) Illinois Tool engineering job-tailors your special milling cutters for maximum efficiency. ITW tool designers often combine several machining operations into a single cutter or gang, with consequent savings of considerable time per piece. Specially designed tools such as these also assure improved accuracy *since accuracy is designed into the tool,* and is not dependent upon several separate operations.

Why not get the most from *your* high speed production machines. Ask your Illinite distributor about job-tailored milling cutters today! Remember, he also carries a complete stock of standard cutters for prompt delivery.

Write today for this helpful new booklet on Metallurgy in Tool Design and Production.

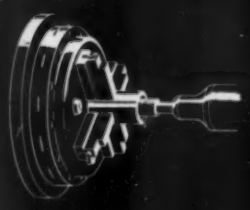
ILLINOIS TOOL WORKS

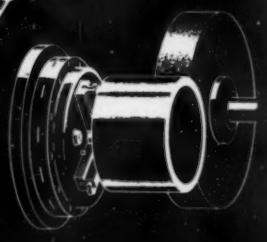
TOOL & INSTRUMENT DIVISION

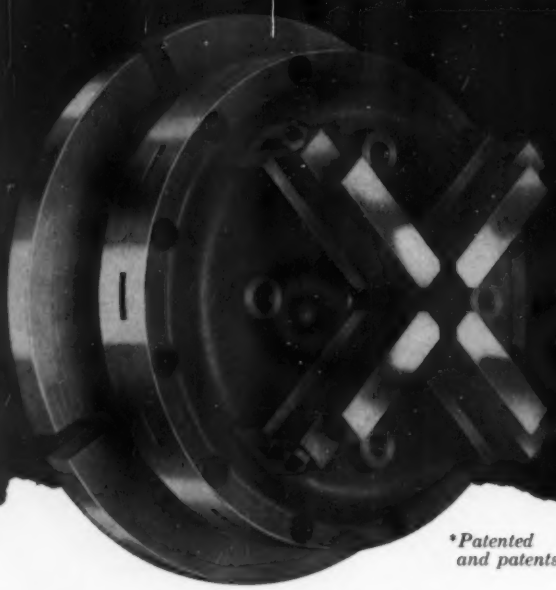
2501 N. KEELER AVENUE • CHICAGO 39, ILLINOIS

Your ILLINITE distributor is just a phone call away.

New ERICKSON
Air Operated or Manual
DIAPHRAGM CHUCKS
for utmost accuracy and concentricity







- ✓ *greater jaw rigidity*
- ✓ *internal or external chucking*
- ✓ *easy diaphragm replacement*
- ✓ *eliminates air leakage*

**Patented and patents pending.*

Basic design of new Erickson Air Operated Diaphragm Chucks* offers distinct advantages in three important areas:

Higher Production Speeds. Reduction in weight over conventional designs means lower inertial forces. Reduction in overhang reduces centrifugal forces; cleats provide sufficient counterbalance. Conventional compression-type adjustment for locating jaws gives greater jaw bearing and maximum rigidity for highest speeds.

Precision Performance. Traditional Erickson precision design and construction for utmost accuracy and concentricity.

Lower Maintenance. Diaphragm construction, with hold-down screws located on flat outer edge of diaphragm, reduces stress concentration and eliminates need for clearance holes through diaphragm for mounting bolts. Design gives higher yield point for diaphragm longevity and easier replacement. O-ring seals eliminate air leakage. Sludge slots around periphery promote escape of grinding dust and other maintenance-causing particles. AA-9808

Write for your free copy of "Erickson Air Operated Diaphragm Chuck" today.

ERICKSON TOOL COMPANY

34453-11 SOLON ROAD • SOLON, OHIO

COLLET CHUCKS • EXPANDING MANDRELS • AIR-OPERATED CHUCKS • FLOATING HOLDERS • TAP CHUCKS
AUTOMATIC INDEXING • MASTER SPACERS • DIAPHRAGM CHUCKS • PUSH-ON ARBORS • QUICK-CHANGE HOLDERS
EXPANDING COLLETS • END-CLAMPING CHUCKS • AIR CYLINDERS (allowing stock to pass through)
EXPANDING JAW MANDRELS • SPECIAL HOLDING FIXTURES

USE READER SERVICE CARD, CIRCLE 43

USE READER SERVICE CARD, CIRCLE 44

Productive Lubrication

here comes real detergency

Stuart's new Hi-D

transparent metalworking compound

Stuart

Hybrid compound keeps grinding wheels open and free-cutting, minimizes machine tool maintenance.

Now, today, there is a metalworking compound that offers extra-high detergency for stress-free grinding, yet does not attack paint, remove way lubricant, or leave crystalline deposits on the machine . . . that lubricates as it cleans, yet does not leave an oil film on the chuck . . . that is just as clear as any synthetic compound, yet is a petrochemical-type solution that is effective and stable at 60:1.

Hi-D is one of the outstanding lubrication developments in Stuart's 90-year history. Yet, it costs less per drum than most "coolants"—up to ⅓ less at proper dilution than some high-priced cutting fluids.

No other cutting and grinding compound is anything like it. Best described as a hybrid, it has all the qualities you look for in a synthetic without any of the disadvantages.

Who uses it? Turn the page and read results being obtained

Stuart

Productive Lubrication

FOR PROFIT-MINDED PRODUCTION MEN

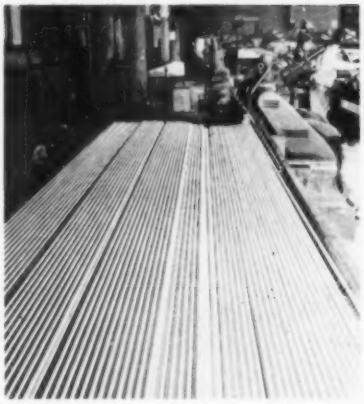
VOL. 1, NO. 4 NOVEMBER-DECEMBER 1959

Stuart's **HI-D** checks rust, reduces costs at La Salle Steel

Stuart's new high-detergency, wide-purpose chemical compound—HI-D—proved to be just what the people at La Salle Steel Company wanted: a cutting fluid that works equally well for grinding or turning, and is capable of inhibiting rust at economically lean mixtures.

During its preliminary evaluation, Stuart's HI-D was put on two Medart turners. We're happy to report (having more than a passing interest in this product) that it made a versatile showing and was immediately put to work on 9 machines in the grinding and turning department. Jobs ranged from roughing cuts of ⅛" to ¼" on the turners to lighter cuts for accuracy and fine finish on the grinding machines. Which brings up one of the ticklish problems at La Salle . . . in-plant protection for highly finished steel bar stock.

In testing other lubricants, La Salle found bars rusted too readily at dilutions of 30:1. But Stuart's HI-D worked efficiently at a 50:1 dilution while it held its high detergency and lubricity potency for efficient turning and grinding. La Salle maintained quality and at the same time reduced cutting fluid costs plenty (45%).



Stuart's HI-D can be used at 50:1 on machines like this centerless grinder as compared with 15:1 for the previous compound.

If you're looking for a cutting compound that combines high detergency, rust prevention, wide job range, high cooling capacity, and excellent lubricity, it will pay you to call in a Stuart representative. Our real objective is even more direct — buy a drum of Stuart's HI-D and test it on your problem jobs.

Phone your Stuart Representative listed at right.

Stuart

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Get Longer Life . . .
Less Kerf . . . Best Non-Ferrous Cutting with

SIMONDS
HARD RIM SAW
(HIGH SPEED STEEL)

This Simonds solid saw (new to the market) has already made a *solid* hit! The men who have to get the work out are sold on the Simonds "Hard Rim's" longer cutting life between sharpenings . . . the better finish it imparts to the non-ferrous metals and plastics it cuts so smoothly . . . the minimum kerf as against non-solid saw cutting. Yes and everyone likes the Simonds "Hard Rim" because of its non-shattering safety when run at high speeds and the protective advantages to personnel.

This very true cutting saw is available in diameters of 8″ to 18″. Try it out — call your Simonds Distributor!

QUICK FACTS

Saw Rim — Made very hard for unparalleled resistance to abrasion and wear

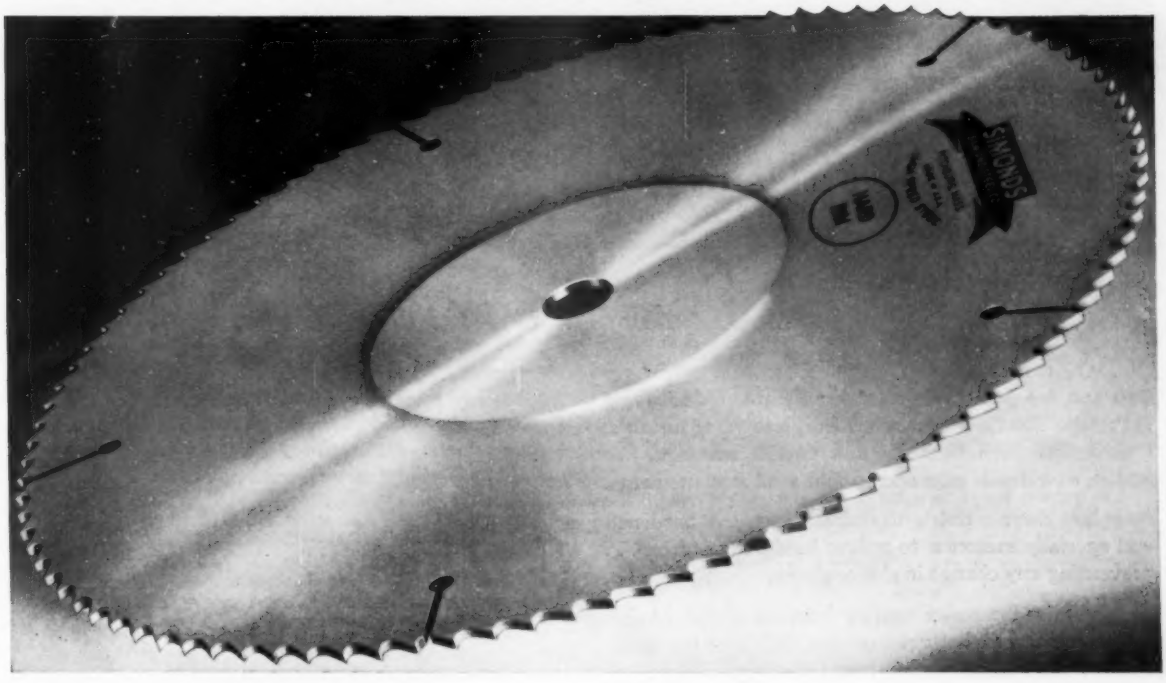
Saw Body — Made just hard enough to keep the saw cutting straight

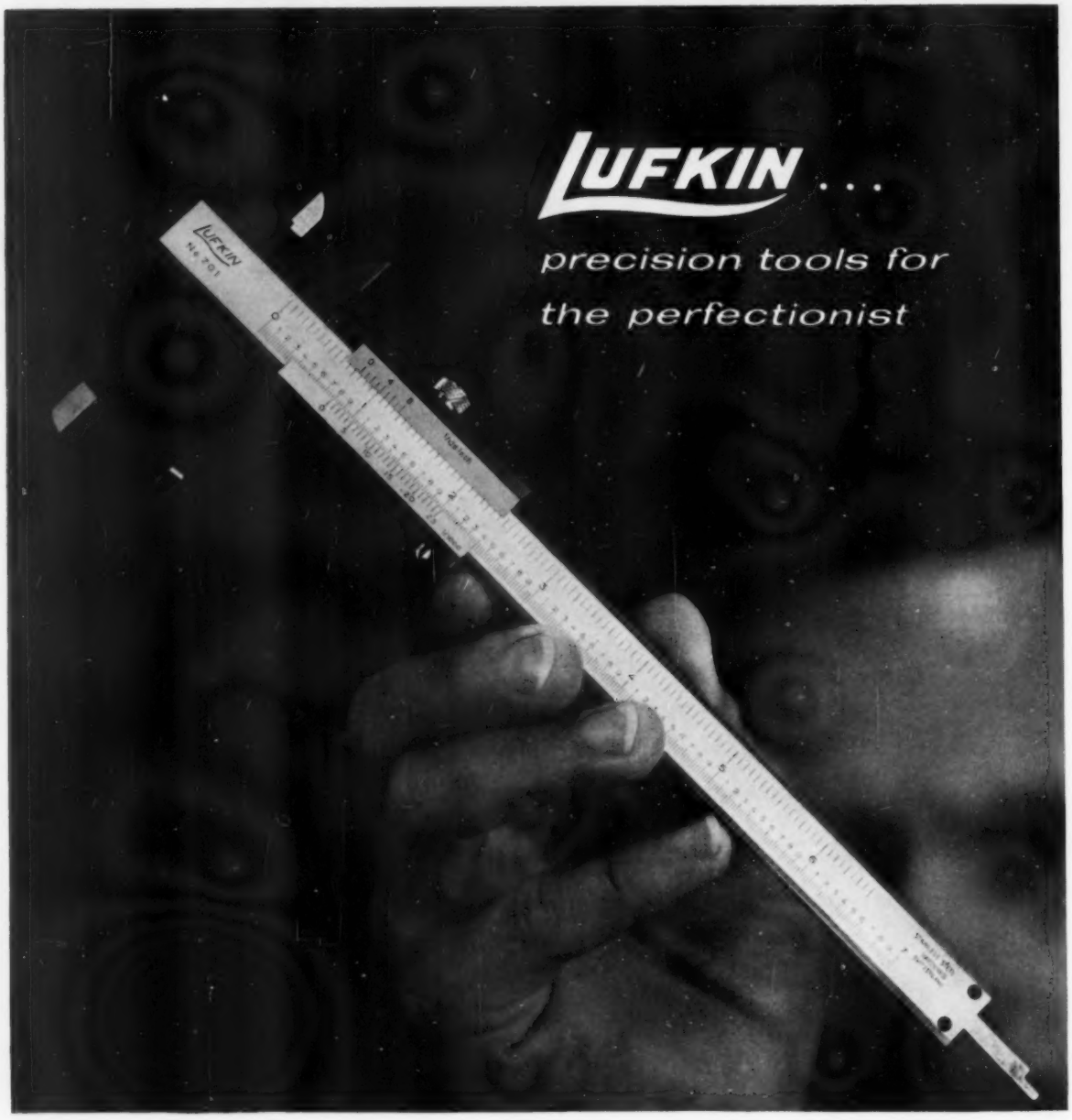
Resharpening — Easily done on standard saw grinding equipment

For Fast Service from Complete Stocks
Call your
SIMONDS Industrial Supply DISTRIBUTOR

SIMONDS
SAW AND STEEL CO.
FITCHBURG, MASS.

Factory Branches in Boston, Chicago, Shreveport, La., San Francisco and Portland, Oregon
Canadian Factory in Montreal, Que., Simonds Divisions: Simonds Steel Mill, Lockport, N. Y.
Heller Tool Co., Newcomerstown, Ohio, Simonds Abrasive Co., Phila., Pa., and Arvida, Que., Canada





New lifetime 701 has vernier that adjusts for jaw wear

You can lap jaws time after time without destroying accuracy. That's because vernier plate is adjustable. One vernier for both inside and outside readings. Use it, too, as a depth gage and to find root measurements.

Nonglare chrome finish on stainless steel . . . hardened and specially seasoned to relieve hardening strains . . . preventing any change in size or shape.

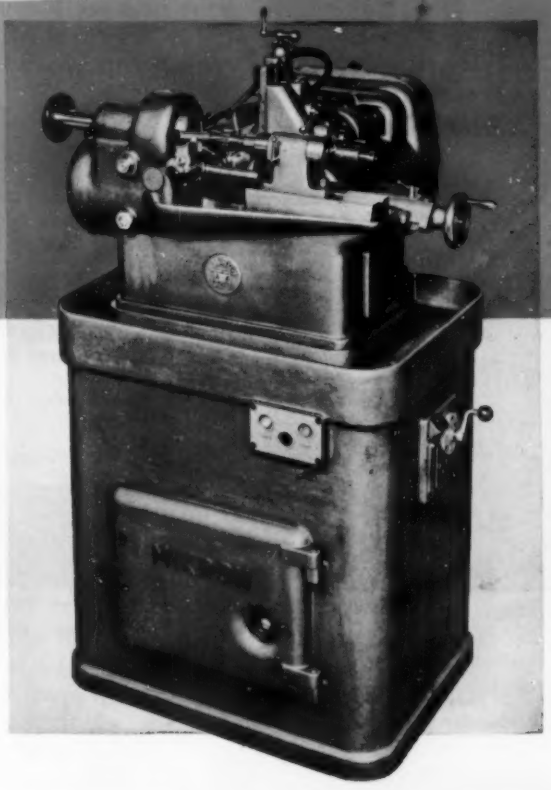
Long vernier for easier reading because of wider spacing. Readings on bottom scale are .001"; on top scale, 1/128". *Only $27.80* in handsome wood case.

Always buy from your Lufkin distributor. He knows precision tools. His stock is maintained to fit your needs. He is always ready to give you prompt and reliable service.

LUFKIN VERNIER CALIPERS
TAPES • RULES • PRECISION TOOLS
SAGINAW, MICH. • MIDDLETOWN, N.Y. • BARRIE, ONT.

WHEN "SECONDS" COUNT...

GO MIKRON



No. 132-01 MIKRON

Spur Gear Hobbing Machine with 15-Second Spacing Accuracy

The "DIFFERENTIAL" between an ordinary gear hobbing machine and a MIKRON is...

MIKRON QUALITY

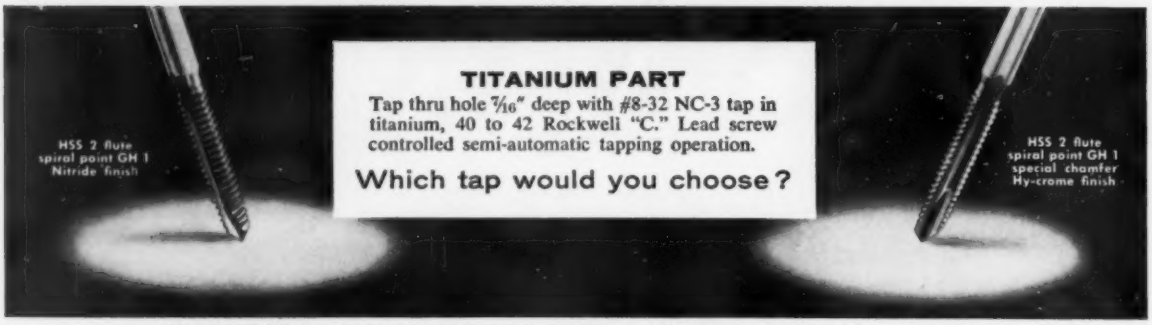
Ask for our Bulletin RH-132-01 which describes the new **MIKRON** *15-Second Spacing Accuracy Machine.*

RUSSELL, HOLBROOK & HENDERSON, INC.

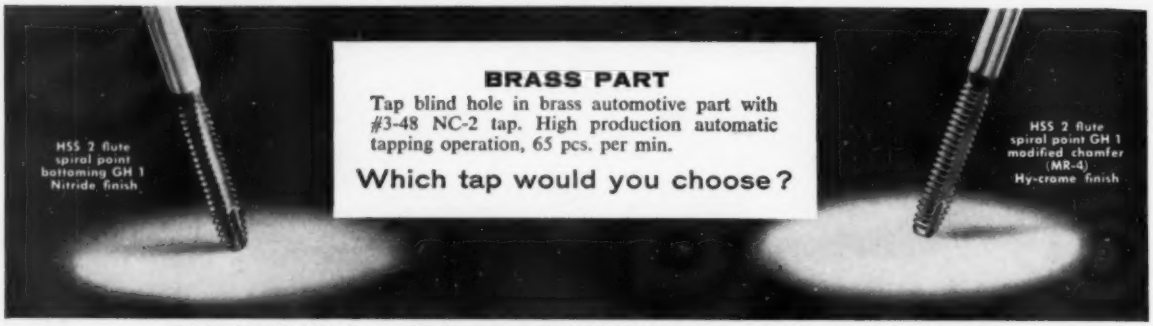
292 Madison Avenue, New York 17, N. Y.

Take the **HY-PRO "TAP-nology" TEST**

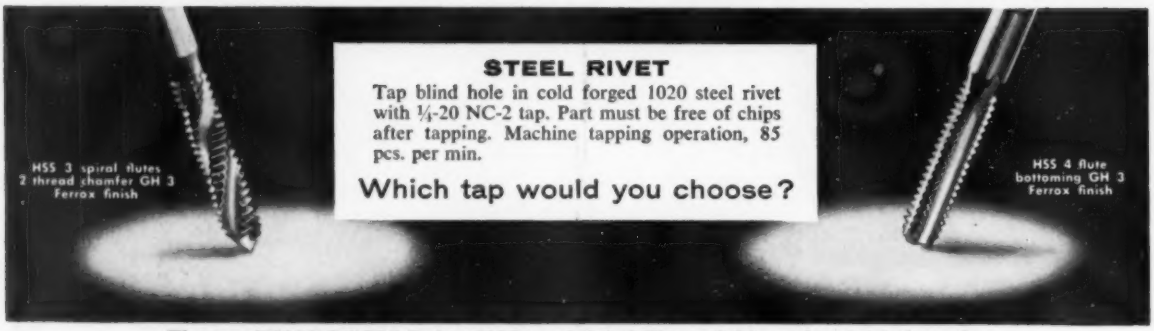
and see how you score in selection for savings


HSS 2 flute spiral point GH 1 Nitride finish
TITANIUM PART
Tap thru hole 7/16" deep with #8-32 NC-3 tap in titanium, 40 to 42 Rockwell "C." Lead screw controlled semi-automatic tapping operation.
Which tap would you choose?
HSS 2 flute spiral point GH 1 special chamfer Hy-crome finish

The HY-PRO tap designed with special chamfer and Hy-crome finish (right) produced 12.3 times the number of holes per tap obtained with the standard tap with nitride finish.


HSS 2 flute spiral point bottoming GH 1 Nitride finish
BRASS PART
Tap blind hole in brass automotive part with #3-48 NC-2 tap. High production automatic tapping operation, 65 pcs. per min.
Which tap would you choose?
HSS 2 flute spiral point GH 1 modified chamfer (MR-4) Hy-crome finish

The HY-PRO MR-4 tap with Hy-crome finish (right) produced 8.2 times the number of holes per tap as obtained with the bottoming Nitride finish tap.


HSS 3 spiral flutes 2 thread chamfer GH 3 Ferrox finish
STEEL RIVET
Tap blind hole in cold forged 1020 steel rivet with 1/4-20 NC-2 tap. Part must be free of chips after tapping. Machine tapping operation, 85 pcs. per min.
Which tap would you choose?
HSS 4 flute bottoming GH 3 Ferrox finish

The new HY-PRO "CR" Series, #307 tap 3 Spiral Flutes (left) produced 4.2 times the number of holes per tap obtained with the 4 flute tap.

Call your local HY-PRO DISTRIBUTOR for standard taps FROM STOCK

Did you pick the right taps? If not, just remember similar errors in selection are common among tap users who buy taps by "habit" instead of *comparative performance.*

Today, tap selection is more difficult than ever, with so many new metals, alloys and plastics in industrial use. So be sure that your "TAP-nology" is up to date. Consult your HY-PRO tap engineering specialist. It costs nothing . . . and these examples show how much it can pay off for you. Write: Dept. C.

HY-PRO TOOL COMPANY

NEW BEDFORD, MASS., U. S. A.

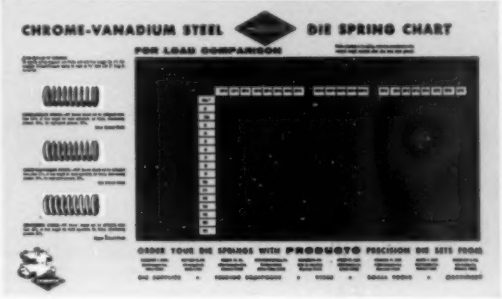
HY-PRO

DIE SET DATA

available from **PRODUCTO**

Die Set Catalog No. 11

This easy-to-use general catalog contains compact, complete listings and illustrations of Producto's broad line of die sets and die makers' accessories. There's a separate price book with *net* prices. A unique new binding enables you to have the technical data and price information side-by-side—no flipping back and forth required. *Color* spotlights key information and speeds up your use of the catalog. Many important new accessory items are included. Free.*

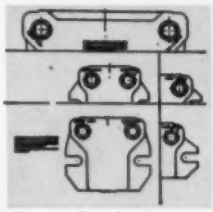

CHROME-VANADIUM STEEL
DIE SPRING CHART
FOR LOAD COMPARISON
ORDER YOUR DIE SPRINGS WITH PRODUCTO PRECISION DIE SETS FROM

Die Spring Comparison Chart

Die spring selection is simplified by this 12″ x 20″ chart in two colors, suitable for wall mounting. Convenient for use at the drawing board, bench or in the stockroom. Covers all three series of Producto chrome-vanadium die springs: Medium-pressure 50% deflection, Medium high-pressure 37% deflection, and High-pressure 30% deflection. Free.*

Die Set Digest

Every issue of this 8-page quarterly publication is packed with valuable hints for designers, manufacturers and users of dies. Hard-to-find information is presented clearly in the *Digest:* "Die Set Maintenance in the Pressroom"; "How to Select and Use Die Springs"; "How to Lubricate for Longer Life". Write and ask to receive *Die Set Digest* regularly. No charge.*

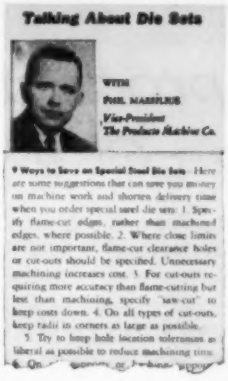


Die Set Templates

Accurate full-size templates for Producto rear-pin die sets. Save time and simplify layout for the busy die designer. $3.50 set. Write today.

Die Set Specification Stamp

Rubber stamp for tracings, prints. Provides spaces for die set ordering information. Free.*



Ad Reprints

Valuable die set know-how is provided in recent "Talking About Die Sets" columns: *How to Save on Steel Specials, Steel vs. Semi-steel,* and others. Send for complete file, free.*

*WRITE TODAY for these useful and informative diemaking aids. Requests on company letterheads will be filled promptly.

THE PRODUCTO MACHINE COMPANY
925 Housatonic Avenue, Bridgeport 1, Connecticut

Wherever die sets are used

PRODUCTO

PRODUCE MORE WITH PRODUCTO PRECISION DIE SETS

When you see uniformity, remember . . .

With Card machine screw taps you get uniformity

Your production's consistent ...because Card taps are uniform

. . . And they give you "quality in details" . . . a feature you'll find only in the finest cutting tools. For example, the name, size, and type of every Card machine screw tap is *rolled* into the shank during manufacture. This deep, highly legible impression lasts throughout subsequent grindings . . . simplifies identification in the crib . . . permits easy reordering. Your Card technical man has the facts about all the "extras" that make Card machine screw taps the choice of shopmen everywhere. S. W. CARD DIVISION, Mansfield, Mass. Card Warehouses: Atlanta, Chicago, Detroit, Fort Worth, Los Angeles, New York, San Francisco.

The CARD Quality

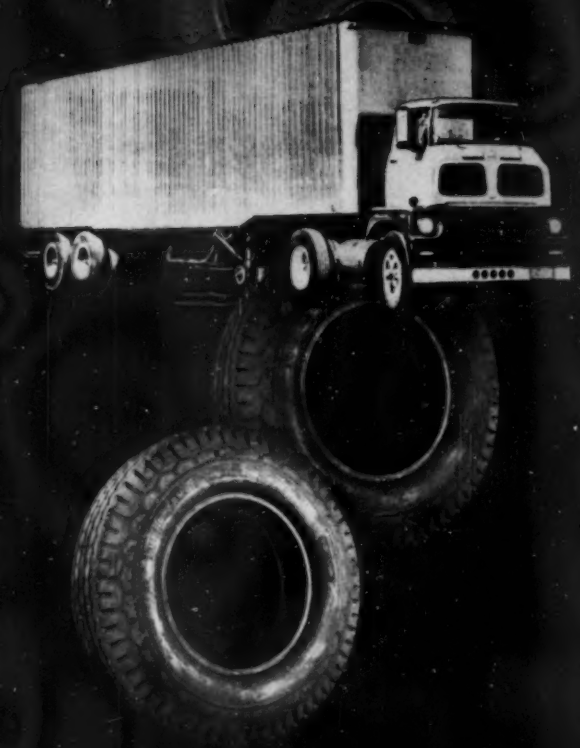
CARD

DIVISION OF UNION TWIST DRILL COMPANY

—Serving you through the best distributors from Coast to Coast

USE READER SERVICE CARD, CIRCLE 49

If you use drills as much as trucks use tires...



Ordering Union drills will cut your production time and costs

The more you use drills the more you need Union

Union drills are made in every type and size you need, with every advantage you need — in materials, design, workmanship and performance — to save you time and money on every drilling job. In your plant, as in plants throughout the country, a Union technical man will be glad to prove that production time and costs can be cut with Union drills, end mills, milling cutters, gear cutters, reamers, hobs, carbide tools and inserted blade cutters. **Available nationally through Union Distributors.** Full stocks are maintained in Atlanta, Chicago, Detroit, Fort Worth, Los Angeles, New York City and San Francisco.

UTD

UNION

TWIST DRILL COMPANY, Athol, Massachusetts

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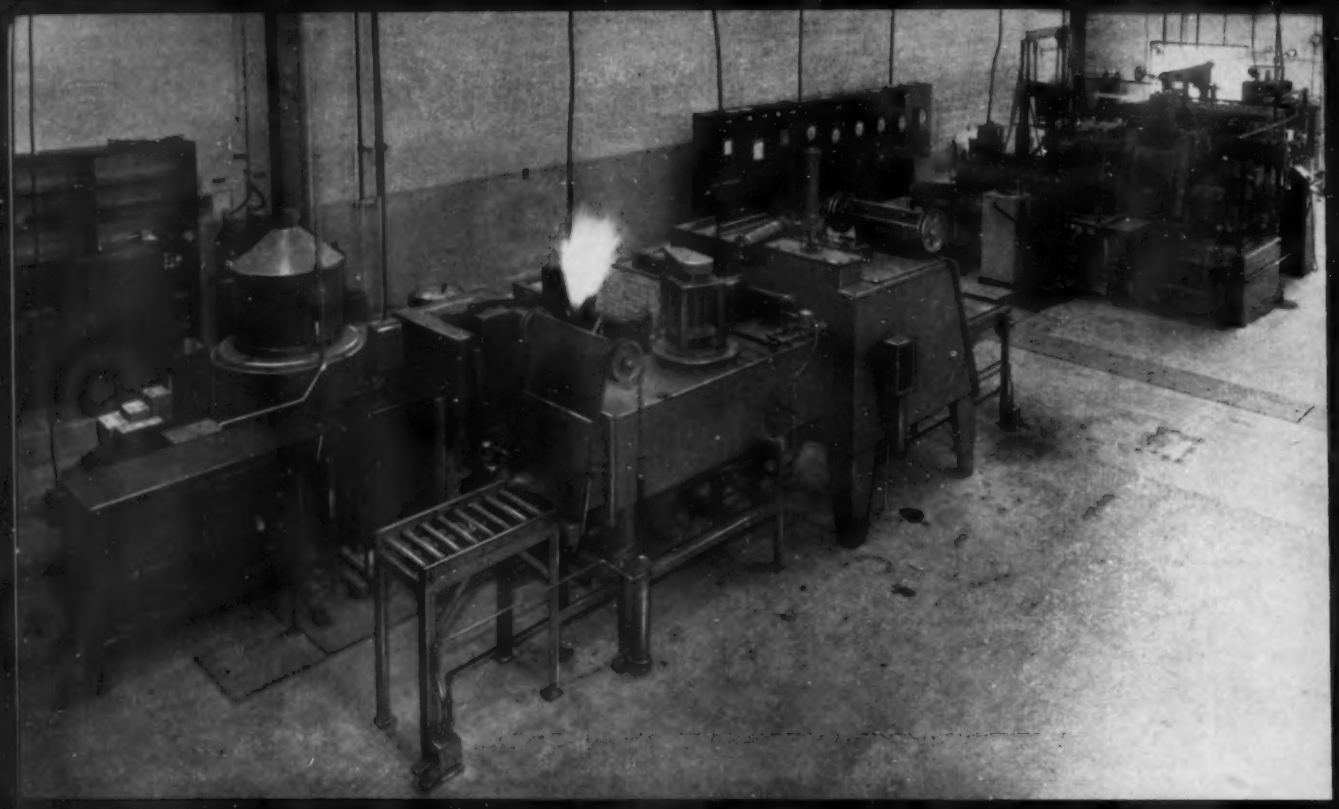
USE READER SERVICE CARD, CIRCLE 50



General view of complete Heat Treating Department at new plant of Lear, Inc., Grand Rapids, Michigan. All equipment including furnaces, Hyen atmosphere generator, control panels, oil quench is by Lindberg.

Electric atmosphere brazing and annealing furnace. Hand pusher type . . . 2100° F. maximum temperature.

Electric pit furnace for treatment of high temperature alloys in dry hydrogen atmosphere. Tap transformer also shown.

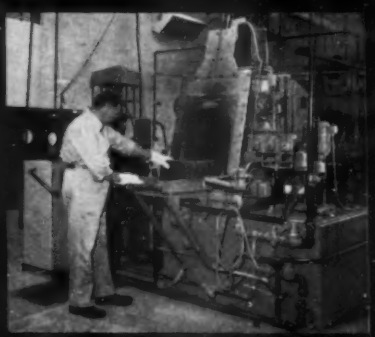
The retort for high temperature pit furnace for treatment of alloys at 2200° F. (left). Production tempering furnace, 22" x 26" work space, shown at right.

Atmosphere tempering furnace, 16" x 24" work space, for both gaseous nitriding and steam treating. One retort in foreground.

LINDBERG Equips Complete Heat Treating Department at Lear, Inc.

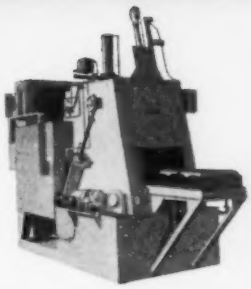
The heat treating requirements for the new Grand Rapids plant of Lear, Inc., were put into Lindberg's hands. We supplied them in the way the photographs show. Our engineers cooperated fully with Lear in the selection of the proper Lindberg equipment and the layout of the complete heat treating department. This installation illustrates one of the big advantages of consulting with Lindberg. Our years of experience in all phases of the application of heat to industry, our complete line of all types of industrial heating equipment offer the best assurance that you can coordinate all your needs in one reliable, experienced source. Consult your local Lindberg Field Representative (see classified phone book) or write us direct.

LINDBERG heat for industry

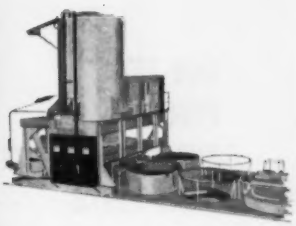


Integral quench furnace with CORRTHERM electric heating elements . . . for carbonitriding and general heat treating.

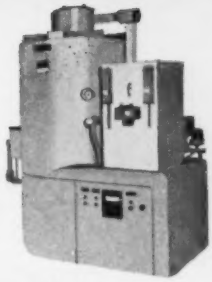
Laboratory Equipment: One-unit box furnace (shown), muffle or for non-oxidizing atmosphere with temperature range to 3000° F.



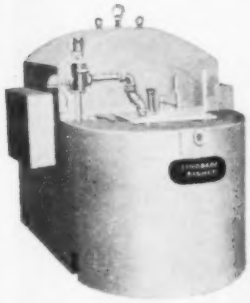
Automatic Carbonitriding Furnaces: Automated integral quench type (shown) with CORRTHERM electric elements.



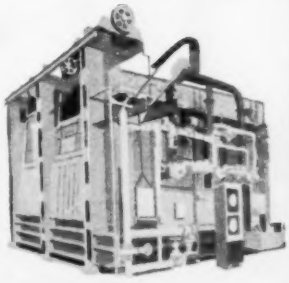
Gantry Type Furnaces: Vertical, controlled-atmosphere, drop bottom, hardening furnace (shown). Complete installation field-installed by Lindberg.



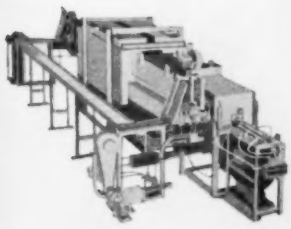
Atmosphere Generators: Hyen generator (shown) for endothermic atmospheres. Generators for all required atmospheres.



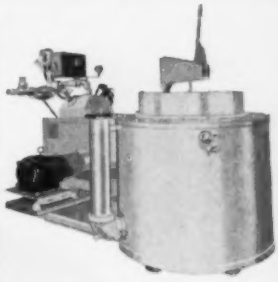
Melting and Holding Furnaces: Electric resistance furnace (shown) with capacities of 750 lbs. to 1500 lbs.



Aluminum Reverberatory Furnaces: Twin-chamber melting and holding furnace (shown) with 45,000 lbs. capacity.



Ceramic Kilns: Fully automatic, atmosphere controlled kiln (shown) has 5 control zones for flexibility. Maximum temperature, 2700° F.



Cyclone Tempering Furnaces: Batch type fuel fired tempering furnace (shown). Famous in metal treating industry for years.

When a product needs heat let Lindberg apply it

Applying heat to industry has been our only vocation for many years. When your product needs heat it makes sense to consult the most widely experienced experts you can find. We believe we have them here at Lindberg. First of all, we manufacture a full line of equipment, the most complete in the field; heat treating furnaces, salt bath furnaces, melting furnaces, induction heating units, ceramic kilns, laboratory and pilot plant furnaces—electric or fuel fired, built in our plant or field installed. So, we can recommend just the correct techniques best suited to your individual requirements and your production methods. Here at Lindberg we have an exceptionally creative group of metallurgists, research technicians and engineers, the best in the business, we vow. You can count on them to answer your industrial heating problems satisfactorily, no matter how complex or unusual. Our world-wide organization, with plants and subsidiary companies in many countries, makes this superior service available to you anywhere.

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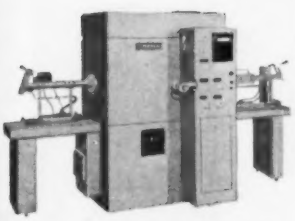
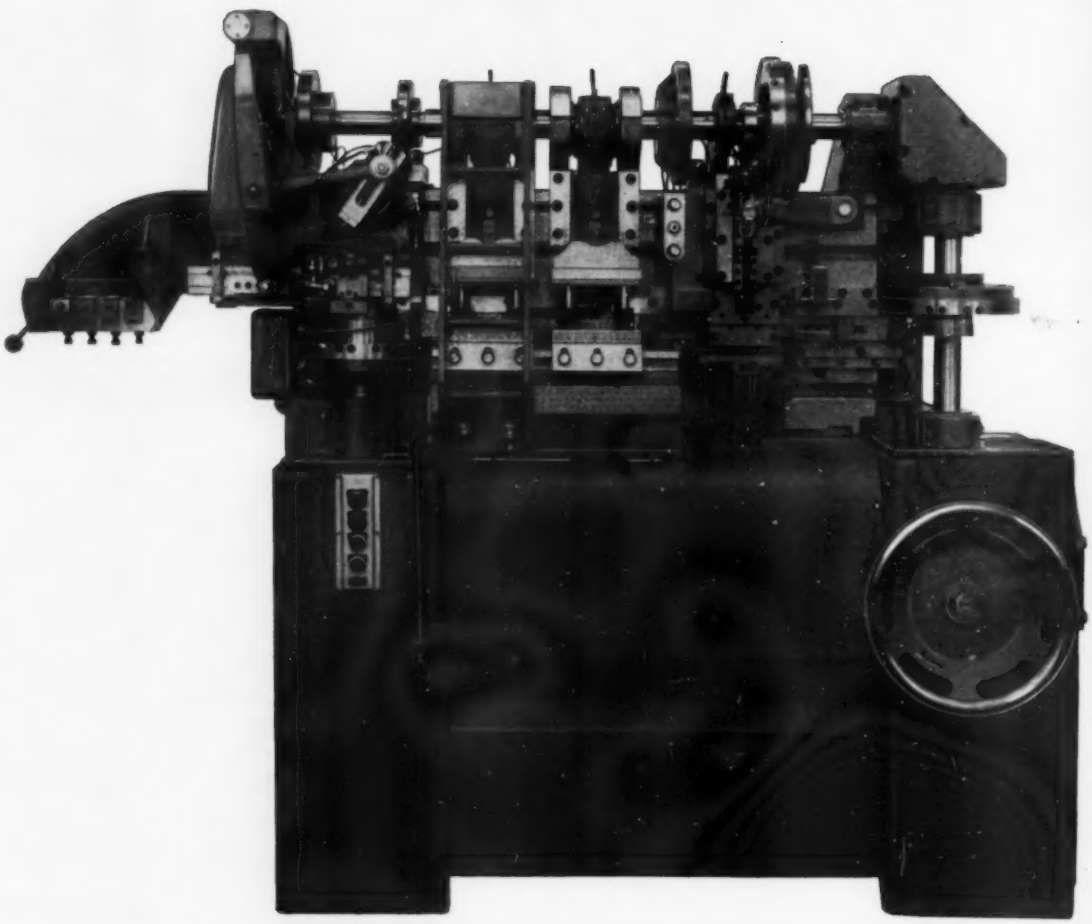
LINDBERG **heat for industry**



High Temperature Furnaces: New Graphite Tube Furnace (shown) with temperature range 2600° F. to 5000° F. for research and production in metal and ceramic fields.

Induction Heating Units: New Lindberg Floating Zone Scanner for precise production of hyperpure semi-conductor materials and metals and Induction Heating Unit (shown).

ON ITS FIRST PRODUCTION JOB THIS REVOLUTIONARY MACHINE...



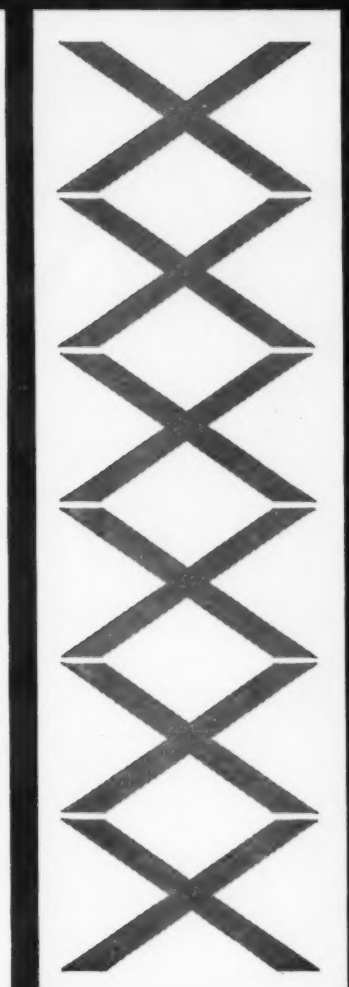
It's the sensational Torrington **Verti-Slide**, a most important **new** production tool. This amazing new vertical four-slide machine promises a genuine revolution in the **high-speed, high-precision, low-cost production** of just about everything in strip or wire that is now being produced on progressively tooled forming presses or conventional four-slide machines. Write or call today for complete technical data—or a Torrington sales engineer.

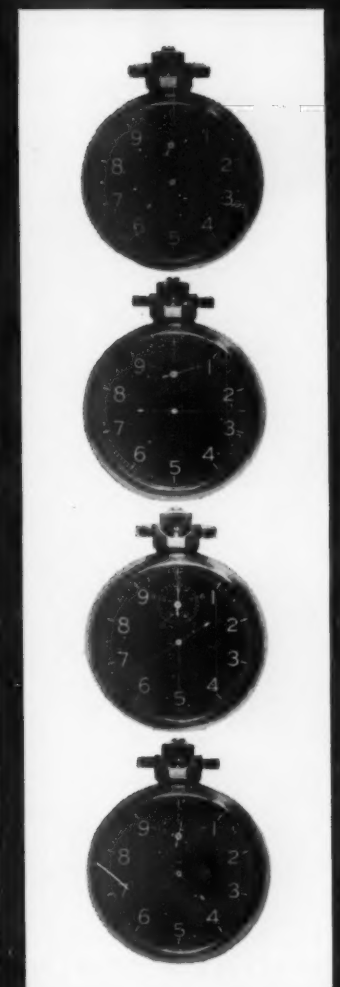
THE TORRINGTON MANUFACTURING COMPANY
TORRINGTON, CONNECTICUT • VAN NUYS, CALIFORNIA • OAKVILLE, ONTARIO

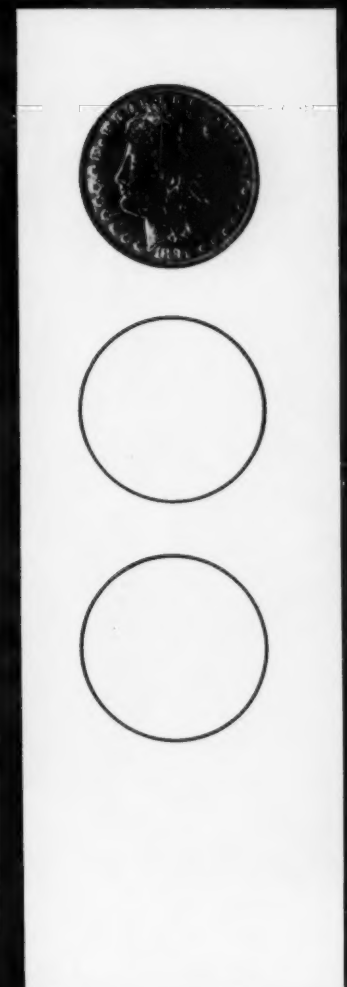
DID THE WORK OF SIX PROGRESSIVELY TOOLED FORMING PRESSES...

AT FOUR TIMES THE SPEED...

AND ONE-THIRD THE COST!







USE READER SERVICE CARD, CIRCLE 52

John Burchfield

–time-study engineer

Teen-ager with a tooling problem...

John doesn't understand tapping, never heard of cold nose boring or butt-welding. To him, a shrink fit could be a serious physical malady.

But the collective wants of kids like John control your machining practices. They set standards—right down to feed, speed, and depth of cut.

They are the reason for carbide tooling, numerical control, and every other advance in metalworking.

A jolting thought is that labor rates, cost of materials, and overhead are growing as fast as the number of John Burchfields. How are we going to make more products, better, at prices these kids can afford?

The answer has to be *increased machine efficiency*. Use of modern machines and the right tooling. Tooling that controls quality while manufacturing a piecepart at *lowest* total cost. Tooling designed by engineers who understand your problem and standards set by John Burchfield and his contemporaries.

Optimation gets you out of the tool business...and into your own

Proper budgeting and emphasis on total cost upset tool superstitions and make you more competitive.

Cutting tools are not an indirect cost.

When you put them in overhead to be husbanded by operating personnel, they become a real obstacle to a cost-reduction program. Monthly review of costs and pressures to conserve tools without knowledge of their worth in relation to the cost of operating machinery can add dollars to piece-parts throughout your shop. In a way, it puts you in a completely different business because *your* work stops while the business of tool sharpening, changing, and resetting adds up to *eight times* the price you paid for the tools.

Scully-Jones has designed precision holding tools that reduce the true cost of cutting tools.

Optimation tooling is tooling that reduces machine downtime for changing and resetting tools, controls tool-change periods economically, prevents overdulling and excessive stock removal during sharpening, and eliminates cut-and-try scrap.

Reducing these elements of tool replacement cost (not just the perishable tool cost) permits you to operate machines at optimum speeds and feeds where unit manufacturing cost is at its minimum.

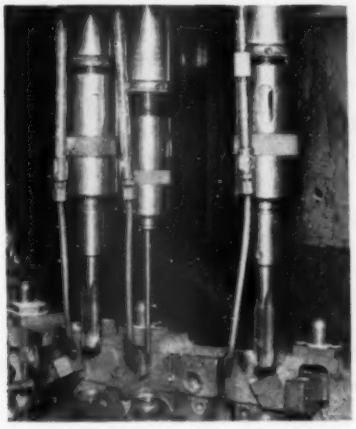
Often, Optimation tooling is the only substantial opportunity to increase machine efficiency. And, the cost of Optimation tooling is certainly low as compared with time on a machine. Here are some of the examples:

BORING MACHINE

This Scully-Jones Better-Hold chuck and special cutter head (below, left) permit fast, high-quality production of rear axle housings, with minimum downtime for tool changes. Twisting the collar seats and unseats the tool in seconds . . . produces a powerful shrink fit on the shank . . . eliminates all clearance and play.

Tool tip spares are kept at the machine and replaced in a stand-by toolholder body. A simple fixture presets sharpened tools outside the machine while the operation continues. Ease and speed of replacement reduce cost and eliminate any tendency to risk off-limit work by stretching out time between tool changes.

ROTARY INDEX MACHINE



The method of changing and resetting 84 individual tools in a 12-station drilling, tapping, turning, facing, and counterboring machine could be the difference between profit and loss, especially on a highly competitive product like oil burner pumps.

That's one reason why this machine is equipped with Scully-Jones "JA" and "JT" floating holders. The "JT" lock-and-eject collet permits fast ejection of chuck and cutting tool just by turning a nut on the nose of the holder. Adjustable adapter shanks permit toolchangers to preset cutting depth outside the machine—there's no delay between changes, no costly cut-and-try scrap. Also, the balanced, constant velocity, flexible drive coupling in all Scully-Jones floating holders provides freedom of movement in all directions, assures quality standards in reaming and tapping operations . . . gives dependable performance with little or tool maintenance.

SPECIAL MACHINES AND STANDARD TOOLS

Here is Scully-Jones' new building-block design recessing tool that increases versatility of drill presses, radial drills and special machines. It reduces tooling costs and speeds grooving, necking, chamfering, and other recessing operations . . . locates either in fixture bushing or work because stop collar and pilot nose assemblies are interchangeable. Cam-controlled feed is fast and automatic. Calibrated, adjustable quick-lock nuts and collar speed setting for accurate location. Depth of cut can be preset in a gage outside the machine to reduce costly in-the-machine adjustments and cut-and-try scrap.

TOOLING SURVEY

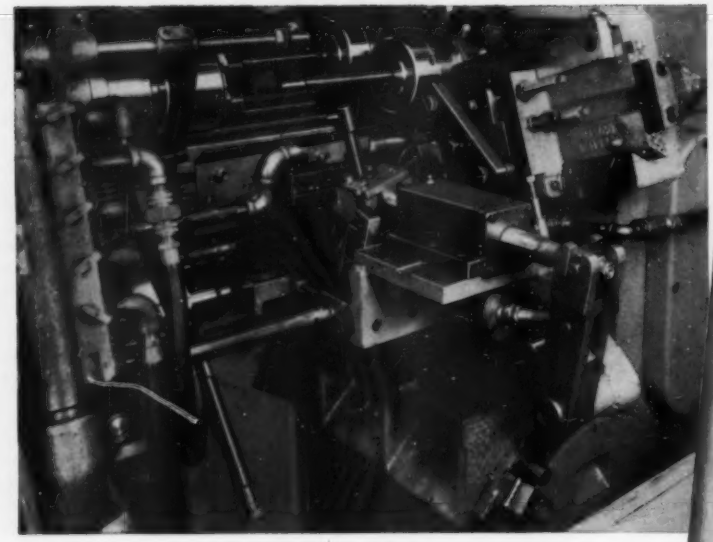
Our engineers will study your machines and give you a complete tooling analysis. Phone BIshop 7-5900.

SCULLY JONES

Scully-Jones and Company

1915 So. Rockwell Street, Chicago 8, Illinois

USE READER SERVICE CARD, CIRCLE 53



Lead-Screw Threading

To Tenths of Thousandths

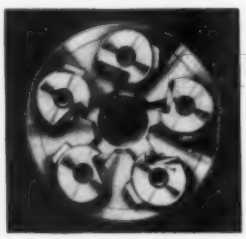
. . . With National Acme 5-Chaser Vers-O-Tools

"Run-out, pitch diameter and pitch variation of the threads on these 3/4-inch studs can't be off more than 1/1000 inch. And, the overall tolerance of the finished piece must necessarily be held to tenths of thousandths." These were the exacting threading requirements of one of the country's leading builders of diesel electric locomotives. 4-chaser heads had failed to meet specifications. But National Acme 5-Chaser Vers-O-Tools, on an Acme-Gridley RB-6 Automatic, arranged for a double-index setup, met the critical threading requirements with ease, producing consistently superior threads at lower cost.

Thousands of users of Namco 5-Chaser Vers-O-Tools have realized similar cost-savings. Here's why . . .

- Out-of-round and drunken threads are eliminated
- Chasers can be ground closer to center, giving smoother, more accurate threads
- 5 chasers lighten chip load on each tool
- Longer chaser life per grind—less machine downtime
- 5 chasers permit threading of parts with flats, slots, keyways

Write for complete information on how Namco 5-Chaser Vers-O-Tools can provide the tolerances and finish for *your* toughest threading job.



National Acme

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Creative Manufacturing Is Tool Engineering

Have you noticed this new slogan on our stationery and in THE TOOL ENGINEER?

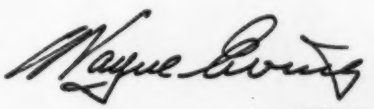
Manufacturing and tooling are so kindred and interrelated that we find ourselves interested in discussing either subject.

In fact, tool engineering must be creative manufacturing. Continuous survey of our readers indicates that the request for technical information has been about seventy percent for manufacturing engineering subjects. Included, of course, are processes, planning, methods, facilities, industrial and quality control, all of which are commonly found in the manufacturing engineering department under the vice president in charge of manufacturing or a manager of that department.

Our Society's leaders have recognized the "kissing-cousin" relationship of tool and manufacturing engineering, in both functions and titles. Their present study of the situation has already provided several definite conclusions.

The Society leaders themselves—the Board of Directors, Officers, and National Committees—are testimony to the kinship of manufacturing and tooling. They come from many sections of the country and, of course, various industries. This diversity provides the understanding and broad viewpoints necessary for arriving at major decisions in long-range planning. Within this group are chief engineers, department heads, managers, vice presidents, presidents, superintendents, and owners—each with his own ideas of Society capabilities and goals.

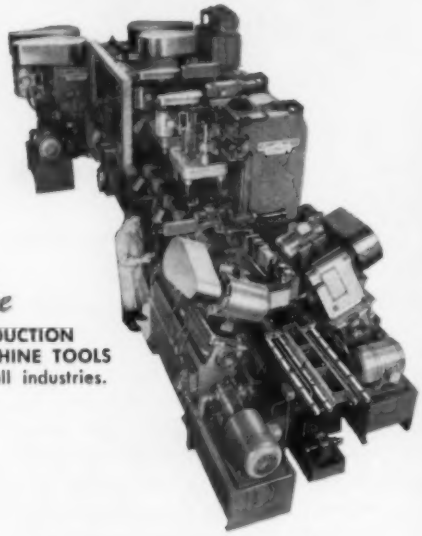
Competition at home and abroad, coupled with the natural desire to improve product and method, provides the mandate that tool and manufacturing engineers unite for the purpose of keeping pace and up to date.



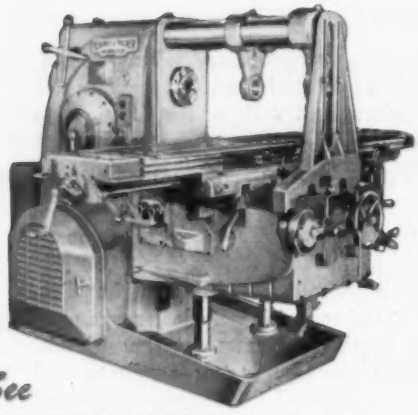
PRESIDENT
American Society of Tool Engineers

Attending the National Metal Show in Chicago?

...then take time out...visit KEARNEY-TRECKER in nearby Milwaukee



See
PRODUCTION MACHINE TOOLS for all industries.



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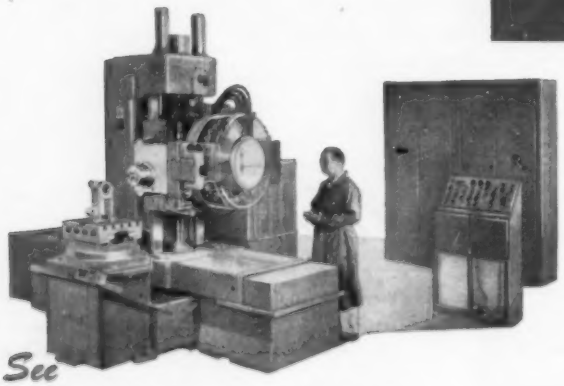

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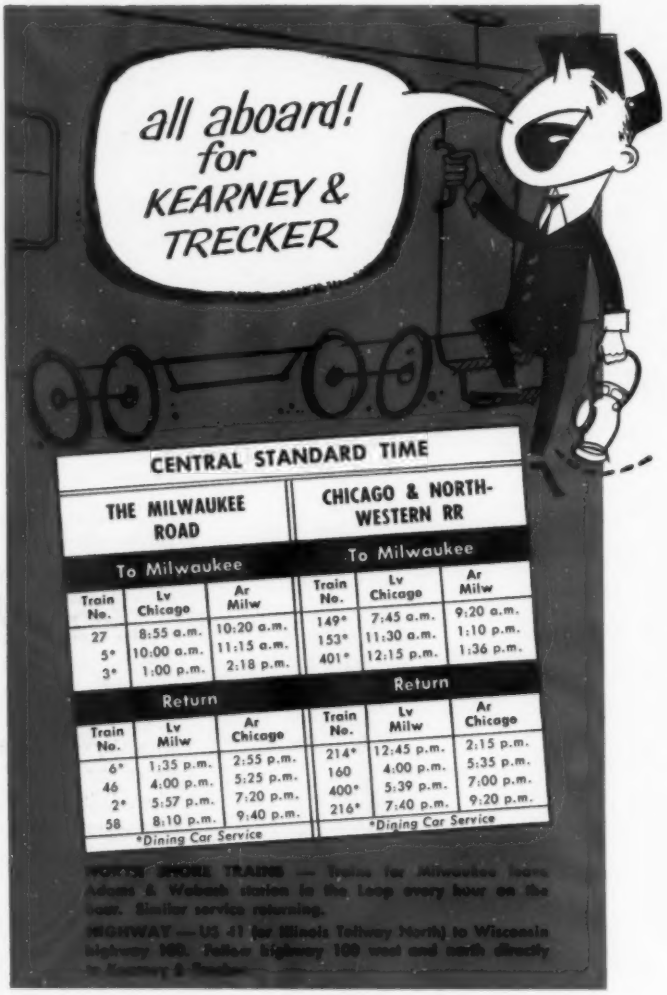

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THE MILWAUKEE ROAD			CHICAGO & NORTH-WESTERN RR		
To Milwaukee			To Milwaukee		
Train No.	Lv Chicago	Ar Milw	Train No.	Lv Chicago	Ar Milw
27	8:55 a.m.	10:20 a.m.	149*	7:45 a.m.	9:20 a.m.
5*	10:00 a.m.	11:15 a.m.	153*	11:30 a.m.	1:10 p.m.
3*	1:00 p.m.	2:18 p.m.	401*	12:15 p.m.	1:36 p.m.
Return			Return		
Train No.	Lv Milw	Ar Chicago	Train No.	Lv Milw	Ar Chicago
6*	1:35 p.m.	2:55 p.m.	214*	12:45 p.m.	2:15 p.m.
46	4:00 p.m.	5:25 p.m.	160	4:00 p.m.	5:35 p.m.
2*	5:57 p.m.	7:20 p.m.	400*	5:39 p.m.	7:00 p.m.
58	8:10 p.m.	9:40 p.m.	216*	7:40 p.m.	9:20 p.m.
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REALISTIC DEPRECIATION POLICIES

—key to industrial growth

By Joel Barlow and Gordon Henderson
Covington & Burling
Washington, D. C.

Nearly 50 percent of American metalworking equipment is obsolete. A broad program of machine replacement is necessary for continued economic growth. Revision of present tax policies would stimulate modernization.

MOST TOOL ENGINEERS don't think of themselves as tax experts. There is, however, one field of taxation where tool engineers can speak with some authority. That field is tax depreciation. Tool engineers are thoroughly familiar with the accelerating rate of technological advancement in productive machinery in this country. This rate of advancement, together with continuously increasing replacement costs, is the greatest problem in the tax depreciation area today.

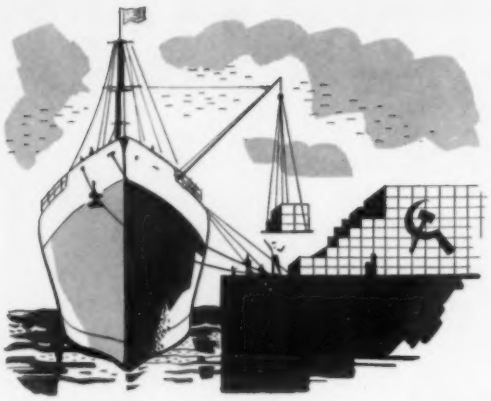
Present depreciation policies of the United States do not reflect technological change. More realistic depreciation policies would give tool engineers better equipment with which to work. They would, therefore, increase company sales and profits. The net result would be to expand the American economy and raise the national standard of living.

The Technological Revolution

No one is better informed about today's technological revolution in metalworking equipment than tool engineers. In the 1920's and earlier, a company could purchase a machine tool or other piece of productive equipment and expect to use it for its entire physical life. This life was relatively long, since the rate of technological progress was slow. Productive machinery operated at slower speeds than are common today and tolerances were less exacting. The metals to be cut or formed were usually fairly soft. With proper care and maintenance, many productive tools could be profitably operated 20 to 25 years, or even longer. Machine obsolescence was not the significant factor it has become in recent years.

Today, with the advent of the Space Age, technological obsolescence of productive equipment has become commonplace. The advent of flight at and beyond the speed of sound has created a need for tougher materials. New jet and rocket propulsion systems demand metals with high heat resistance.

Products must be made to closer tolerances. A few years ago, tolerances were in terms of several thousandths of an inch. Today, in some applications, tolerances of millionths of an inch are speci-



Obsolescence in the American industrial plant is bound to have an increasingly serious effect upon American ability to meet Soviet economic offensives.

fied and there is even talk of "splitting a millionth." To a tool engineer of a few years ago, this would have sounded fantastic.

These developments mean that productive machinery now has to cut and form metals of unprecedented toughness, and to perform at tolerances hitherto considered impossible. The defense industry was the first to feel these changes, but they have not been confined to that area. Manufacturers of consumer products are quick to take advantage of new materials and new techniques.

Demand for machinery that could handle these tougher materials and achieve closer tolerances has led to rapid developments in productive machinery and equipment. An engineer of the early 1900's would have felt at home if he had been suddenly transported to a plant of the 20's, 30's or even the early 40's. It is safe to say, however, that he would find modern production lines almost unbelievable. Modern machines operate at greater feeds and speeds and setup time has been reduced. Automation has become an increasingly important factor.

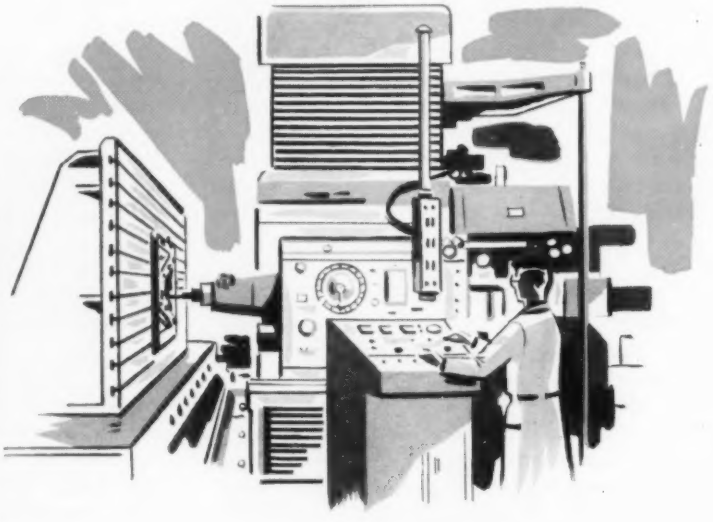
Companies can no longer expect to use their productive machinery for 20 years or more. Continuing developments in end products, the advent of automation and trends in metalworking machine design combine to make obsolescence the primary factor in depreciation today. The impact of obsolescence is heightened by the ever-increasing use of special-purpose, rather than general-purpose, tools. When a company purchases a new machine tool today, it can usually expect that tool to be obsolete and replaceable in 10 years or less.

U. S. Industrial Plant Obsolete

Engineers in this country have created the world's most advanced productive equipment and they are continuing to improve it at an accelerating pace. They have put this country in the forefront of industrial machinery development. Yet, paradoxically enough, the industrial machinery that is being used in the United States is more obsolete than that of almost every other major industrial country. A recent survey by McGraw-Hill discloses that nearly 50 percent of the productive machinery and equipment in this country is obsolete. In contrast, the productive machinery and equipment in most West European countries is significantly more modern. The obsolescence factor in West Germany is only 10 percent.

This is a shocking and dangerous state of affairs. Unless obsolete machines are replaced, high labor rates, coupled with obsolete tools, will price American products out of the world market. In fact, this is already happening, and its effects will become more apparent yearly unless something is done.

Engineers in this country have created the world's most advanced productive equipment.



Aside from problems of foreign competition, obsolescence in the American industrial plant is impeding economic growth and the desired increase in the standard of living. It is also bound to have an increasingly serious effect on American ability to meet Soviet economic offensives.

Depreciation Policies at Fault

American tax depreciation policies are among the most backward in the world. Metalworking equipment in use today is obsolete largely because depreciation allowed for Federal income tax purposes is inadequate.

The relationship of tax depreciation to the condition of American plants is simple. Depreciation is too often thought of as an accounting concept. In accounting theory, depreciation does not provide any funds for replacement. It is only an allocation of cost over time. But tax depreciation, even though it has been based on accounting theory, is not simply an accounting concept. Depreciation for tax purposes does provide money for asset replacement.

In recent years, nearly two-thirds of the dollars used to purchase assets have come from depreciation deductions. One-third, however, have had to come from other sources, either from earnings or new capital investments. Much of this additional one-third has been needed just to replace existing assets. When the dollars for asset replacement must come from earnings without benefit of the depreciation deduction, the 52 percent Federal tax on corporation income causes difficulty. What this tax means is that, for every dollar to invest in replacement machinery, a company must earn twice that amount. It should earn $2.08 just for replacement—not to speak of expansion, improvement, return on the owners' investment and the effect of inflation.

Obviously, the depreciation deduction has a direct bearing on the amount of money available for investment in productive assets such as machine tools. Just as obviously, the rate of depreciation for tax purposes has a direct relation to the rate at which this money becomes available. The trouble is that today the rate of depreciation allowed for tax purposes is too low. Assets must be written off over depreciable lives that are much too long.

This has a harmful effect on the American economy. When depreciation rates allowed for tax purposes are too low, businessmen know that they cannot hope to recover their investment in a tool by the time that tool becomes useless or obsolete. New investment, whether for replacement or expansion, is discouraged. Slow depreciation acts as a brake on modernization as well. There is a reluctance to replace an old machine when it has not been fully "written off." There is also a universal hesitation to invest in a piece of productive equipment that may become obsolete in five years unless that investment can be recovered from tax allowances in a reasonably short period of time.

Theoretically, under present law companies are allowed to write off the cost of productive assets for tax purposes over the period these assets will be useful in the business, i.e., over the economic useful lives of those assets. But this is not what is happening in practice. The revolution that has occurred in the economic useful lives of productive assets is not reflected in current tax depreciation practices. In an age when tools are becoming obsolete in ten years or less, companies are still being forced to depreciate metalworking equipment over periods of 20, 25 or even 33⅓ years.

The reason is easily found. With the exception of reforms made in 1954 and 1958, tax depreciation policies have remained unchanged since 1934. They have stayed static for a quarter-century—a quarter-century of unprecedented progress in everything except depreciation.

Before 1934, taxpayers could choose the useful lives over which they would depreciate their assets. If the Treasury thought the life chosen was wrong, it had the burden of proving it an unreasonable choice.

During the Great Depression, however, there was a tremendous need for revenue, but little income to tax. To help solve this dilemma, a Congressional committee proposed to reduce all depreciation deductions arbitrarily by a flat 25 per cent. The U. S. Treasury, concerned about the constitutionality of this procedure, suggested an alternative method of raising the same amount of revenue. It proposed to shift the burden of proof in depreciation matters to the taxpayer. This was done in February, 1934.

Slow depreciation acts as a brake on modernization.

Owing to inflation, a $10,000 machine tool, purchased three years ago, may cost $20,000 today. This has stimulated proposals for inflation adjustments to depreciation deductions.

Useful lives can never be predicted with absolute accuracy. At best, they are always an educated guess, based upon past experience, current developments and future expectation. The shift in the burden of proof was designed as a means to indirectly achieve the desired 25 percent reduction in depreciation deductions.

Although the original intention of Congress was the establishment of a three-year program, the resultant Treasury policy has lasted for 25 years. This policy is coupled with an elaborate table of "average" useful lives for depreciable assets. The table was originally issued as a guide but it has become the rule.

The table was last revised in 1941. Average useful lives contained in the revision were based upon taxpayer experience during the Depression. It is apparent to most tool engineers that application of the table to today's conditions is absurd. But that is what is being done.

Some relief was provided in 1954 by allowing taxpayers to use the double-declining-balance and sum-of-the-years-digits methods for new assets having useful lives of three years or more. These methods (see THE TOOL ENGINEER, June 1957, p. 76-77) permit larger deductions during the early part of an asset's life than are available under the straight-line method. The double-declining-balance method allows two-thirds of a machine's cost to be written off during the first half of the asset's life. Under the sum-of-the-years, digits method, three-quarters of the machine's cost can be written off in this same period.

In addition, Treasury officials have attempted to ease the burden-of-proof problem. Unfortunately, agents in the field still follow the old burden-of-proof rule, hampering progress along these lines.

The effect has been to retard modernization and replacement, and to cause obsolescence in the American industrial plant. Some companies, particularly the larger ones, have been able to successfully plead the case for shorter write-off periods before the Tax Commissioner. The expert knowledge of tool engineers has been invaluable at such times. Until basic policies are reformed, however, unreasonably long write-off periods for industrial machinery will be the general rule rather than the exception.

Effects of Inflation

So far nothing has been said about inflation. But inflation, coupled with higher labor rates, has also slowed the replacement of productive machinery. Tool engineers who request or design new tools know that a $10,000 tool, purchased three years ago, may cost as much as $20,000 or $25,000 to replace today.

The impact of inflation on modernization programs is obvious. When it costs $25,000 to replace a $10,000 investment, the additional $15,000 must come from new financing or earnings. (The same is true of the original $10,000 to the extent that depreciation rates have been too slow.) To provide the $15,000 from earnings, a company must make $31,250 before Federal income taxes. Just to replace its $10,000 investment, a company either has to earn $10,000 and obtain $15,000 of new capital, or it must earn $41,250 before taxes—over four times the cost of the asset replaced.

Clearly a company that pays a 52 percent tax on, or distributes dividends from, earnings needed to replace existing assets is paying taxes on capital and distributing phantom profits. Reliable estimates have been made that depreciation has been under-

stated, from a replacement point of view, by $4 billion to $6 billion a year.

This has stimulated proposals for inflation adjustments to depreciation deductions. Many companies have already made adjustments of this nature for book or replacement-planning purposes.

One tax proposal is to make an adjustment for rising costs each year in a company's depreciation deductions. The deduction for the year in question would first be computed on an actual cost basis. It would then be increased by the amount of growth in replacement cost since the assets were purchased. Some government cost index could be used to make this adjustment.

A similar method has been used in foreign countries, but the American tax structure has always been tied to historical dollars, unadjusted for changes in the value of those dollars. There are many who object to departing from this system.

Other proposals have been developed that would not depart so far from traditional tax theory. One of these is called "reinvestment depreciation." It works this way: When an asset is replaced, the additional cost that represents the rising price level can be deducted immediately in the first year. To go back to the example, when a $10,000 tool costs $25,000 to replace because of inflation, a deduction of $15,000 can be taken immediately. The remaining $10,000 cost can be deducted over the life of the new tool. This method, of course, provides no protection from rising price levels before existing assets are replaced with new ones.

Adoption of one of these proposals would be helpful in ending industrial obsolescence, but none of them would solve the useful life problem. Even with adoption of one of these methods the useful life problem would still deter capital investment. On the other hand, a solution of the useful life problem will help overcome the effect of inflation. The faster an investment can be recovered through depreciation deductions, the smaller will be the impact of inflation and rising price levels on the invested dollars. Solution of the useful life problem is therefore the first step that must be taken in depreciation reform.

Solving the Useful Life Problem

The basic need in depreciation reform is to make write-off periods catch up with present-day technological advances and to put the knowledge of the tool engineer back into tax practices.

The best solution of these basic problems is offered by the "bracket approach." In the place of the present "useful life" tables and burden-of-proof policies, the bracket approach substitutes a simple system. All depreciable assets are grouped into a few basic categories. For each category, a bracket or range of useful lives is assigned. Taxpayers can choose any life within this range without challenge. Longer or shorter lives must be justified by proof satisfactory to the Treasury. The bracket of lives assigned each category must take into account our growing obsolescence problem. The bracket for machine tools, for example, should be 7 to 10 years.

The bracket approach is similar to the "class rate system" that has been used with great success in Canada. In the class rate system, all depreciable assets are grouped into 14 broad categories, and a

Tool engineers must help educate legislators and the public to the need for enlightened tax depreciation policies.

Realistic depreciation provides for a healthy economy.

maximum depreciation rate is assigned for each category. Any taxpayer can use the maximum rate without challenge. The useful lives are comparatively short. Machine tools, for example, are assigned a 20 percent declining-balance rate.

Initial Allowances

Great Britain has approached the problem in a different way. British taxpayers are allowed an "initial allowance" in the year an asset is purchased. Thereafter depreciation deductions are figured on cost reduced by the initial allowance. For machinery the present initial allowance is 30 percent of cost.

An initial allowance was introduced into American law in 1958 by the Small Business Tax Revision Act. American taxpayers can now take an initial allowance of 20 percent in the first year. But the allowance in this country, unlike the English practice, is limited to $10,000 each year.

The initial allowance does not solve the useful life problem. However, by permitting taxpayers to recoup a substantial part of their investment during the early life of an asset, without challenge, it can help in reducing the effects of unrealistic useful lives.

Congress could make a most desirable reform of our depreciation system simply by eliminating the $10,000 limitation on the initial allowance.

Action Needed Now

Depreciation reform is long overdue. The effects of backward depreciation policies are becoming worse each day. America can no longer afford to put off the day of needed change.

Officials in the Treasury are beginning to appreciate the importance of this problem and the deleterious effect of present practices on our domestic and world position. They would like to do something about it. But they need support, and they find that too many in industry are complacent and unconcerned. Too many have a "leave it to the politicans" attitude. Too many are shirking public responsibility. Businessmen who refuse to do anything about depreciation are not only liquidating their businesses and losing out to their competitors—they are hurting our entire economy by their lack of concern about a vital national problem.

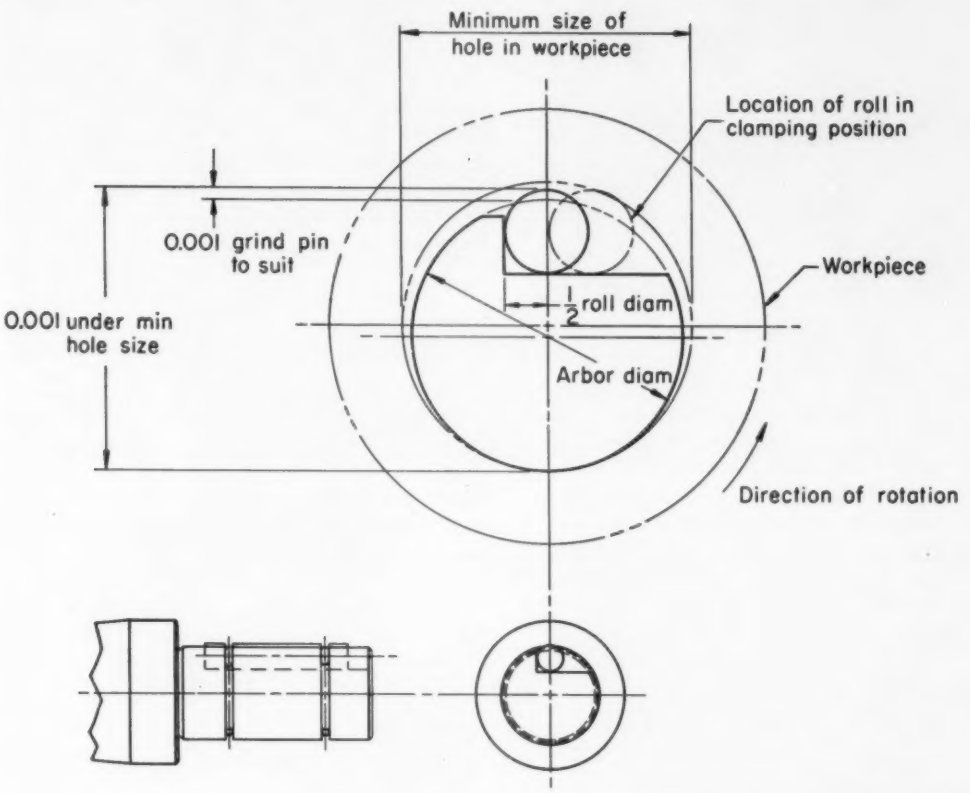
Industry must accept the challenge: more and more people must join the farsighted business leadership now working to bring about depreciation reform. Only in this way can public officers and representatives be stimulated to respond.

Reform can and should take place simultaneously on two levels. The first is at the level of the individual company. Companies should give greater effort to making a case for shorter lives that will convince revenue agents even under the present system. The second, and more important, is at the government level. Political leaders must be encouraged to adopt the bracket approach, and to take the $10,000 limitation off the initial allowance.

In both, the role of the tool engineer is vital. He has the knowledge of technological change on which realistic depreciation rests. This knowledge must be utilized. The most important job ahead, to borrow an engineer's phrase, is to tool up for tax depreciation reform. If we fail in this, we will soon have little else to tool up for.

Gadgets

Ingenious Devices And Ideas To Help
The Tool Engineer In His Daily Work



Pin Arbor

Pin arbors, in which clamping force is provided by the wedging action of a pin or roller against the workpiece ID, provide a fast and efficient method of locking a workpiece for machining. The effectiveness of the clamping action, however, depends on the design of the arbor. Arbors designed with the dimensions and relationships shown in the accompanying drawing give excellent performance in production. Cutting torque holds the workpiece securely in the arbor.

Robert M. Dickson
Springfield, Mass.

ENTER NOW!

Get your Gadgets Contest entry in now. See list of cash prizes and other details elsewhere in this issue.

Indicator Protection

Centering rough castings or machined parts with an indicator gage causes vibration and wear on the indicator mechanism.

Transparent pressure sensitive tape wrapped around the workpiece as shown provides a smooth surface for the gage. The tape should be wrapped tightly but should not be pressed down so that rough peaks on the surface come through.

This same method can be used when aligning parts for milling cast plates and centering splined or keyed shafts and gears.

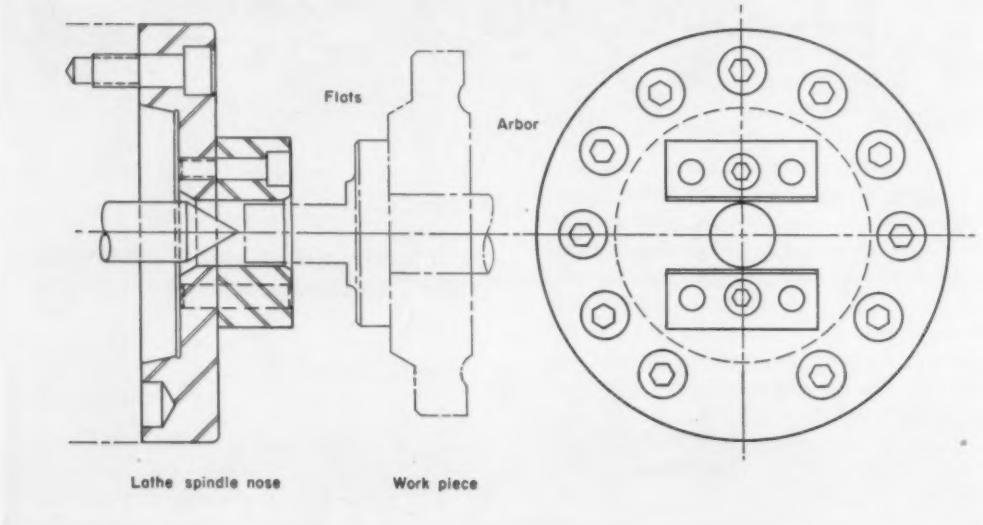
Clint McLaughlin
Rockaway, N. Y.

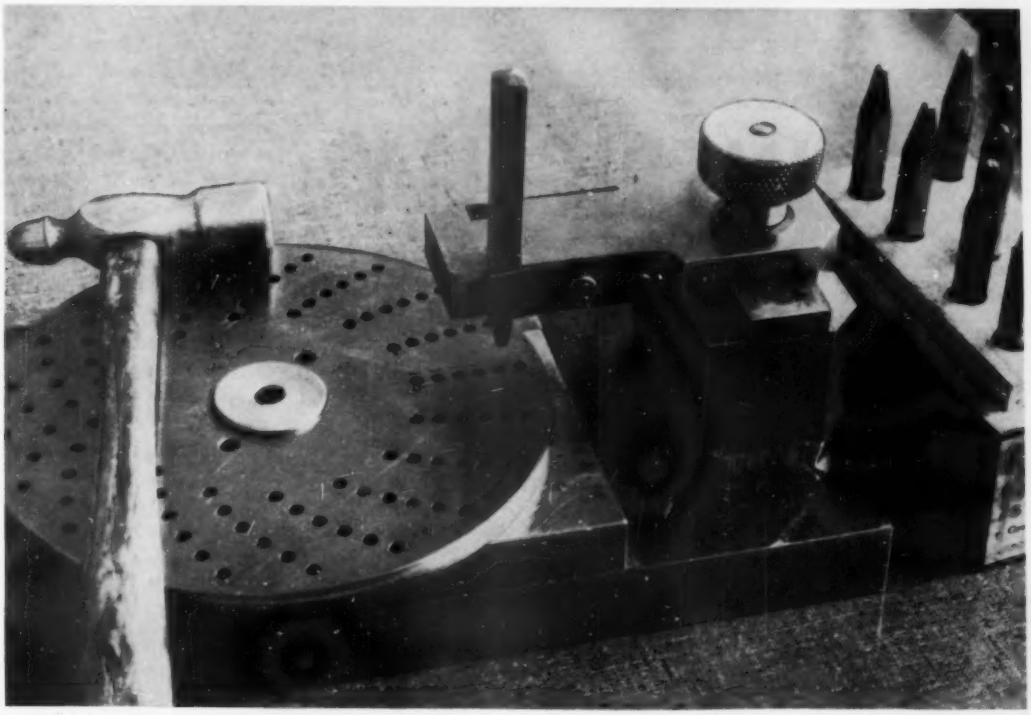
Arbor Driver

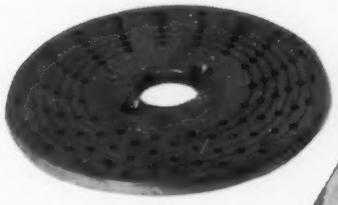
In shops where a large number of engine lathes are used for turning gears and similar parts, it is advantageous to have a driving standard for arbors. If all arbors are designed with the diving tang the same size, setup time and tooling costs are cut.

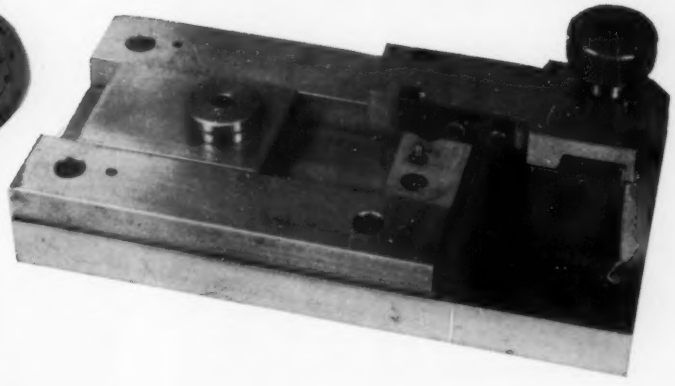
Illustrated is a method of driving arbors of standard size. Flats are ground on the arbors to provide a tang thickness of one inch or any other convenient dimension to be used as a standard. The fixture shown bolts directly to the lathe spindle nose and keeps the arbor from turning. Two driving lugs are screwed and doweled to the face to retain the arbor tang. Clearance of about $\frac{1}{32}$ inch should be provided for free insertion of the arbor.

Roger Isetts
Kenosha, Wis.





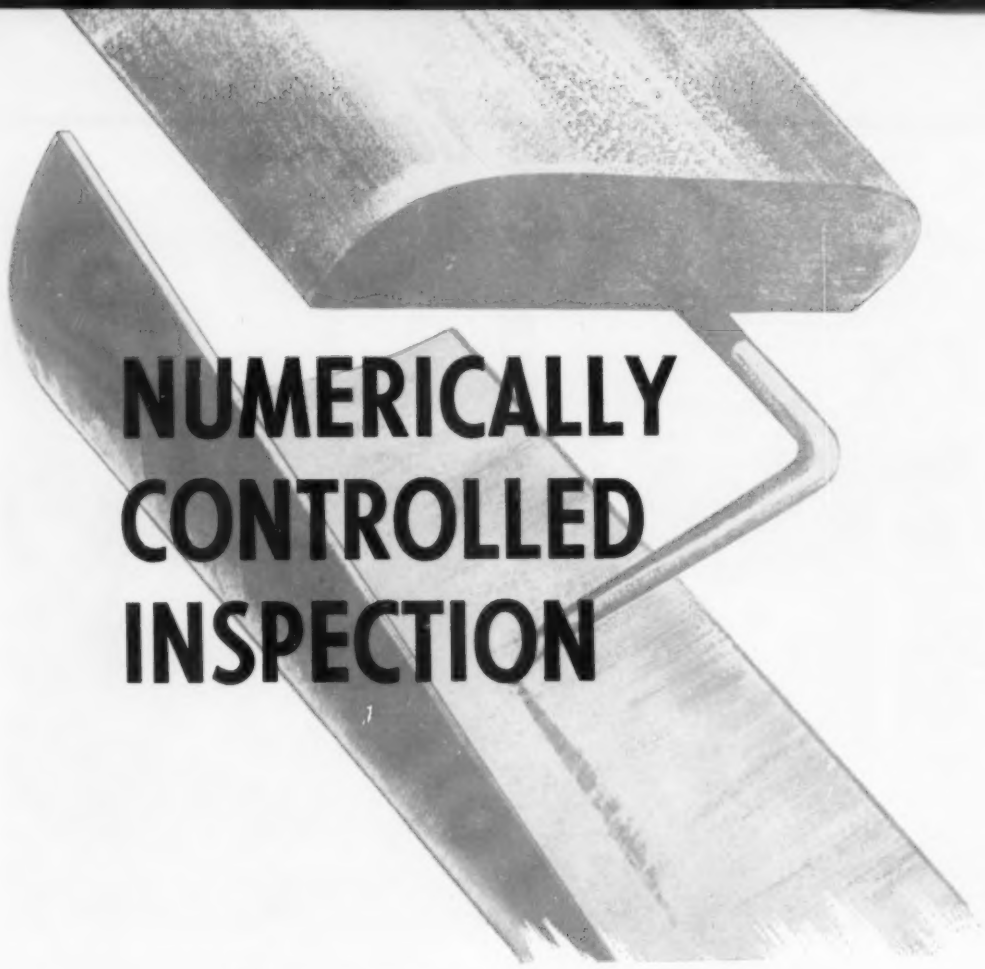




Number Marking Jig

For number marking of circular rows of holes in index plates the illustrated jig is useful. Standard individual numeral stamps are used for low cost. These stamps are surface ground on front and back surfaces to a uniform thickness so they will fit accurately into the stamp holder on the jig. The jig has a sliding locator so that plates can be moved radially to correct positions, under the stamp, for each row of holes. A hardened and ground stud locator on the block which slides between two rails, fits a central hole in the workpiece. A small dowel pin under the stamp holder, seats in one hole in each circle to further align the work under the stamp. The stamp holder, made of tool steel, hardened and ground, has two stamp slots, one on each side, and is movable sideways for correct positioning of one digit on each side of the hole. The correct poistions for this movable stamp holder are determined by fingernail check on each corner. Stamps are retained in the slots by flat springs on each side of the stamp holder. Marking is done with a small hand hammer.

H. J. Gerber
Member-at-Large
Stillwater, Okla.



NUMERICALLY CONTROLLED INSPECTION

Tape-controlled inspection is a logical companion to tape-controlled machining. Together, they lead to impressive time and cost savings in metalworking.

By William B. Johnson

Chairman
Numerical Control Coordinating Committee
Rocketdyne Div. of
North American Aviation
Canoga Park, Calif.

SINCE THE ADVENT of numerically controlled machining, parts are produced ten times faster than by conventional methods. Until recently, inspection techniques have not kept pace with this dramatic increase in productivity. Today, however, numerical control has been applied to inspection, with equally dramatic results. Automatic inspection machines are in production use at Rocketdyne and other companies. Also, scribing or machining of inspection templates by numerical control has substantially shortened lead time and improved accuracy at many companies.

Inspection Machine: Inspection of turbine blades is an interesting example. These blades have complex blade and root sections. Accuracy requirements are stringent and inspection by conventional methods took many hours per blade. This time has been greatly reduced through the use of a Warner & Swasey Universal Probograph inspection machine, *Fig.* 1.

The principle of operation of the machine is simple. Briefly, the machine compares nominal or blueprint dimensions, recorded on an eight-channel punched paper tape, with actual dimensions, which are checked by a probe. The probe is moved from point to point by vertical, longitudinal and transversal slides. Deviations from nominal dimensions are recorded on a strip chart.

For checking airfoil contours, the operator posi-

Abstracted from Paper 217 "Total Concept of Numerical Control," presented at the 27th ASTE Semi-annual Meeting. Copies of the complete paper are available for purchase from Society Headquarters.

tions the part to be inspected in the machine, zeroes the probe, inserts the punched tape into a tape reader and presses the start button. The vertical slide positions the probe to the height of the section to be inspected. Then the longitudinal and transversal slides move to position the probe opposite the part at the first probing station in this section. One slide then moves the probe until contact is made with the part. This contact is recorded by a stylus on a strip chart in the recording unit. Since measurements are recorded at the instant of contact, any overshoot of the slides has no effect on the measurement.

All measurements are recorded on the strip chart as a series of dots. The position of each dot with respect to lines on the chart showing the nominal size indicates the deviation of the measured coordinate from the nominal coordinate at that point. Measurements taken in the longitudinal, transverse and vertical directions are all recorded in this way.

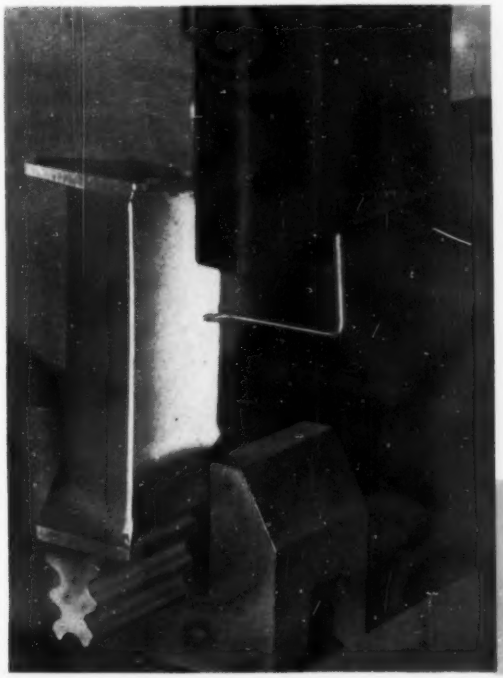
After the probing motion, the part retracts, clearing the probe, and the tape directs the slides to move to the next programmed station. The next point is checked in similar fashion and succeeding measurements are taken, one after another and under direction of the tape, until all points have been measured. Then the machine stops automatically and the operator removes the part.

Probing measurements and stationing movements can be made with any of the slides. It is often desirable, due to the nature of the measured part, to switch the functions of the slides from probing to stationing and vice versa during part measurements. Such changes can be programmed in the tape, making them fully automatic.

The recording unit records probing measurements made in the X, Y and Z axes. A typical chart record is shown in *Fig.* 2.

There are two nominal lines on the chart, one for increasing measurements and one for decreasing measurements. Each dot on the chart corresponds to one measurement and the position of the dot relative to its corresponding nominal line indicates the magnitude and the direction of the deviation of the measured point from the nominal coordinate of that point. The two nominal lines are the heavy lines that are shown through the middle of the two groups of dots. Dots that fall between the two nominal lines are minus (less metal); dots outside the nominal line are plus (more metal). Lines are automatically drawn across the chart under control of the punched tape to separate groups of measurements such as individual airfoil sections. Dots along the sides of the chart are for reference.

In general, thickness deviations are measured by



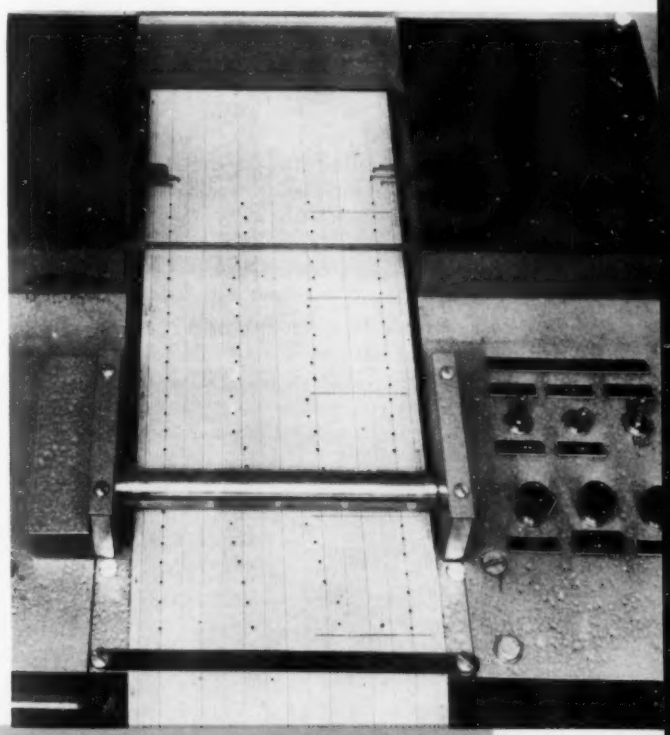


Fig. 1. (left) Probe of tape-controlled inspection machine checks contours of turbine blade.

Fig. 2. (above) Deviation from absolute part measurements is recorded on strip chart. Each dot on chart represents one measurement.

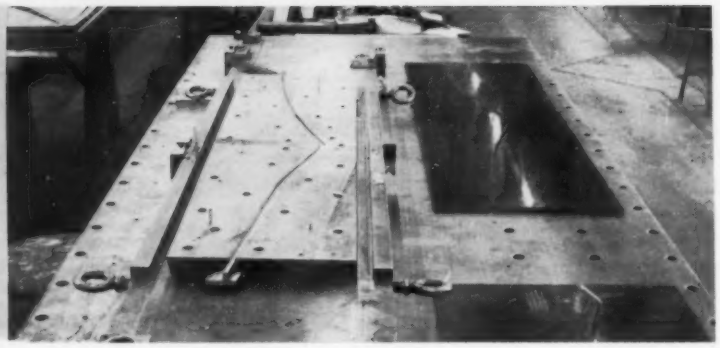


Fig. 3. Die set (left) and checking templates (right) were completely produced by numerical control. Templates were also inspected by numerical control.

the distance between the dot on the right side of the chart and the corresponding dot on the left side of the chart. Contour error is indicated by waviness of the lines of dots. Bow is shown by a lateral shift of one airfoil section with respect to another on the chart. Thus deviations can be seen at a glance.

Checking of rocket engine thrust chamber templates, *Fig.* 3, is an example of the time savings possible through numerically controlled inspection. The conventional method of inspecting these templates requires two days; inspection now requires only 15 minutes with numerical control. For this operation, a Cincinnati milling machine with a Numill control system was used as an inspection machine. The control tape contained part-path information, rather than the cutter center-line location used for machining operations. Incidentally, the templates themselves were produced by numerical control. The deviation of the contour from absolute accuracy was only 0.0009 inch.

Template Making: Numerical control provides a rapid and accurate method of scribing base lines and milling contour templates, using either punched or magnetic tapes. Lines or milled templates can be produced to net or shrink scales as required.

An example of the application of numerical control to these operations is production of a lot of 160 master templates. The original templates were designed by a computer, then automatic computer routines were used to produce a series of 48 different scribed or lofted master templates and master milled templates. Machining was accomplished on a Morey profiler equipped with a General Electric control system.

Total cost, including all engineering time, computer time, control tapes and machining time, was less than $5000 and the entire job was completed in a period of less than ten days. Two engineering changes were integrated into the job during this period of time. Production by conventional methods would have required six to eight weeks.

The accuracy of the templates produced by numerical control was within ± 0.001 inch, rather than the ± 0.005 inch possible with conventional production methods. The expensive and time-consuming procedure of lofting was completely eliminated. Cost savings were in excess of $10,000. Despite the significant time and dollar savings, it is felt that the improved accuracy possible with numerical control is the greatest benefit realized.

Total Concept: Numerically controlled inspection is only part of the total concept of numerical control. As applied at Rocketdyne, this concept includes:

1. Comparison and evaluation of rocket engine design parameters by computer during preliminary and advanced design
2. Use of complete mathematical-analytical definitions to express the engineering design intent
3. Use of these definitions to produce engineering test programs—by numerical control—for checking out preliminary designs before the manufacturing phase is reached
4. Making engineering drawings directly in the language of numerical control
5. Poduction of tooling such as templates, loft boards, cams and the like by numerical control, utilizing the mathematical-analytical engineering design definitions
6. Manufacture of parts either directly by numerical control or through the use of tooling produced by numerical control
7. Checking of parts during manufacture by using optical templates or master milled inspection templates that are produced by numerical control
8. Inspection of completed parts on a numerically controlled measuring machine where appropriate.

This total concept—the use of numerical control from the engineering design stages through final inspection—make it possible to fully realize the benefits of numerical control in all phases of product design and production.

STANDARDIZATION speeds production

By P. B. Messina*
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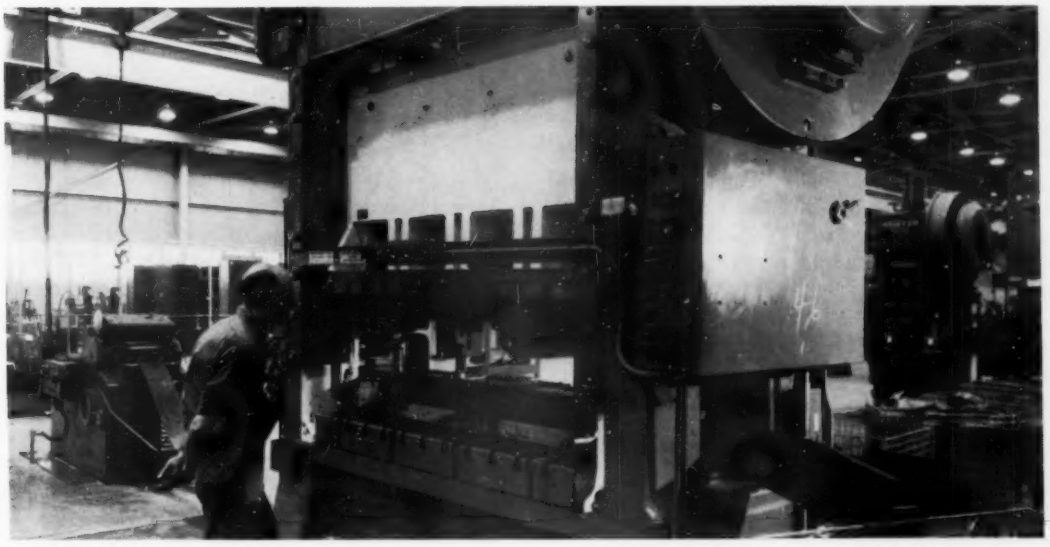
Changing to standard sizes of product parts enabled tool engineers at Westinghouse to improve and automate production methods. The changes raised the quality of parts, reduced scrap and increased overall plant productivity.

WHEN PLANNING TOOLING for new manufacturing facilities, many times it pays to re-examine product design. Minor changes in product construction often can allow for a new approach to tooling to make it simpler and more automatic. Both these improvements were realized by Westinghouse in manufacture of channel-shaped fins for distribution transformer tanks.

The channel fins, which assist in heat dissipation, are resistance welded to the tank walls. For application to various tank models, the fins formerly were fabricated in 21 different lengths, ranging from 14 to 43 inches. All other dimensions other than the length were identical for all fins. Because of the many different lengths, the fins had been fabricated in two operations: blank and cutoff, and form. An

*Senior member ASTE Atlanta chapter.

Fig. 1. Four different sizes of parts are blanked in this press with an adjustable die. Coil feed helps to make the operation completely automatic.



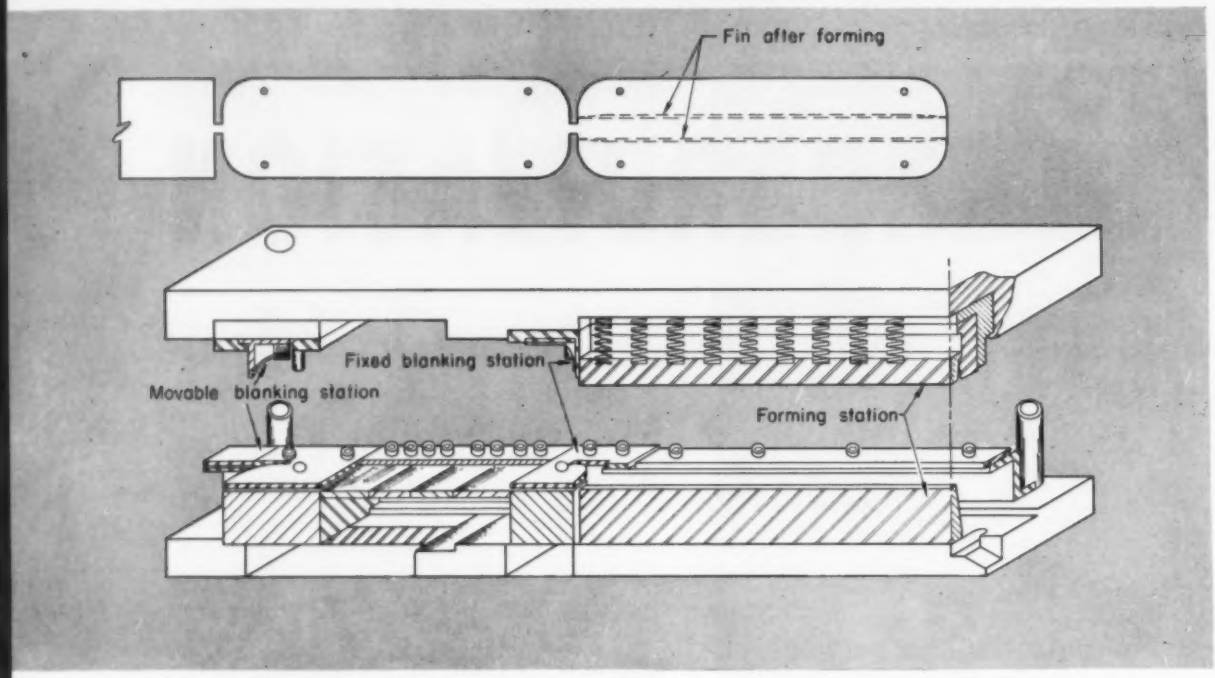


Fig. 2. Cross-section of adjustable die and blank. Blanking die at left is moved to accommodate different part sizes. A second blanking station is fixed.

adjustable stop was used for the cutoff to suit the various lengths.

The first operation was strip fed by hand; the second required manual placement of the blank against a gage. Careful review by product design and factory planning personnel resolved the requirements down to four sizes: 17, 20, 23 and 27 inches. Reduction of the number of sizes to four made use of an adjustable progressive die feasible. In addition, since the cross-section of all fins was the same, one strip width could be used for all lengths. This made coil feeding into an automatic press possible, *Fig.* 1.

The adjustable die, *Fig.* 2, has two parts. The first part has two substations. The first substation blanks the radii of one end of the fin, leaving a ½-inch tab for moving the stock. Both the top and bottom shoe of this substation can be moved to accommodate the four lengths of parts. The second substation is stationary and blanks the required contour on the other end of the fin.

The second part of the die forms the fin into its channel shape. The forming block is 20 inches long and forms 17 and 20-inch fins. A seven-inch extension is added to the block when forming the two larger sizes. When the extension is not in use, it is removed and an inclined roller conveyor is placed at the end of the die to allow discharge of the fins into a wire mesh container.

The use of coil feed and the combination of blanking and forming in a progressive die reduces the scrap ratio, since only the lead end of the coil is trimmed instead of each strip end. Proximity switches have been installed to insure that the fabricated fins are discharged from the die before the next stroke of the press—thus permitting automatic operation of the dereeler, feeder, and two-stage die. The scrap trim drops into a chute which leads to an in-floor vibratory conveyor that carries it to salvage.

He's so mad he not only rejected this but all that I might produce in the future."

how to machine ZIRCONIUM alloys

By A. O. Schmidt
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and
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Originally developed for nuclear reactors, zirconium alloys have characteristics that should lead to many industrial applications. Despite their classification as exotic materials, these alloys can be readily machined when their special characteristics are taken into account.

NUCLEAR TECHNOLOGY has resulted in the application of a number of new engineering materials such as the zirconium alloys. Zircoloy No. 2, for example, is used to clad fuel elements in nuclear power reactors and it can replace stainless steel in reactor structures.

Because of good mechanical strength, heat resistance and outstanding corrosion resistance, zirconium alloys are also used in chemical processing equipment. These desirable characteristics will lead to a wider range of applications in the future, pointing up the importance of better machining methods.

Abstracted from Paper 224, "Machining of Zircoloy," presented at the 27th Semiannual Meeting. Copies of the complete paper are available for purchase from Society Headquarters.

Machining Characteristics: Tests run to determine the machining characteristics of Zircoloy No. 2 showed that this zirconium alloy can be milled with carbide or high-speed steel cutters. Large relief angles (approximately 10 deg) are effective in eliminating the tendency of the material to build up on the flanks of the tool, which causes heavy burrs on the workpiece, overheating and sparking. Positive rake angles can be used to reduce the amount of heat in thin workpieces, eliminating their tendency to deform. Adherence of the chip to the cutter can be prevented by spraying an emulsion on the workpiece surface before the start of the cut. Sharp cutters with sufficient clearance angles, coarse feeds and elimination of chips from the table of the machine minimize fire hazards.

Although zirconium is pyrophoric (tends to burst into flame spontaneously) difficulties on this account occur only in those machining operations which produce fine chips, such as sawing, and finish operations in milling, grinding, turning, and boring. This hazard can be overcome by flooding the tool and workpiece with an emulsion and by not permitting tools to dwell in a cut. Friction of a tool rubbing against a workpiece while not cutting can generate enough heat to ignite small chips.

It has been the experience of reactor manufacturers that machined Zircoloy parts are sometimes unsatisfactory because of a smeared metal residue left by the metal-cutting process. This can be a consequence of chip crowding and burnishing action of the tool, especially in confined areas. Since even hand operations often will not eliminate this condition, it is a prime requirement to design tools that

stay sharp and cut clean. A cutting operation which causes heat and burrs can also produce oxidation to a considerable degree. In high-speed machining, for example, temperatures can be attained that are close to the melting temperature of the workpiece.

Oxidation can occur in any machined material and is influenced by high temperatures near the cutting zone. The degree of oxidation of chips which are smeared against the freshly machined surface and of burrs on the workpiece is strongly affected by these temperatures. Normally this action would not interfere with the subsequent usage of a workpiece, but it cannot be tolerated in reactor components that come into contact with fuel elements.

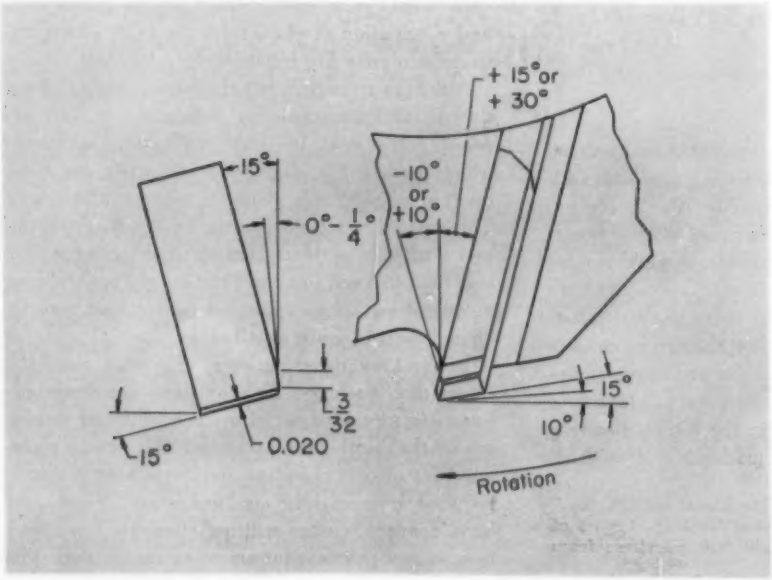
Preliminary Tests: Because of the requirements described, an effective tool for machining Zircoloy must have positive axial rake angles, especially for milling a pocket. An ordinary spiral slab mill has a negative axial rake angle at one side by virtue of its single-spiral configuration. Thus, to permit positive axial rake angles to be effective at both sides of a milled pocket or recess, it is essential to use a set of herringbone slab mills. If no Zircoloy material is available for experimental cuts, exploratory tests regarding cutter design, surface finish, dimensional accuracy, clean cutting, and holding of the workpiece can be carried out with flat strips of SAE 1020 cold-rolled steel. Such preliminary tests will give a valid indication of conditions to be encountered later except for the influence of the relief angles, which must be increased to 10 deg or more for machining Zircoloy.

Zircoloy material can be sawed on a bandsaw ordinarily used for steel. A combination of friction in the cut, lack of cutting fluid, and fine chips from the sawing operation, however, can easily generate enough heat to ignite the chips. A copious supply of an emulsion and no idling of the saw in the cut serve effectively to prevent the start of fires. A dry powder extinguisher of the type used for magnesium fires is also satisfactory for zirconium. Fire extinguishers employing carbon dioxide, carbon tetrachloride, or water should not be used.

During preliminary tests, milling of flat surfaces was done successfully with carbide face mills having positive radial rake angles, designed to readily permit changes of the radial rake angle at the cutting edge. Teeth were set into the cutter body at either 15 deg or 30 deg positive radial rake angle. A negative or different positive primary radial rake was superimposed on the cutting edge.

Whether the primary rake angle was —10 deg or +10 deg, or any value in between did not appreciably affect cutter performance as long as the relief angle was approximately 10 deg. The large positive rake angle helped reduce the power required in the cut and also improved chip formation. A relief angle of 5 deg caused excessive smearing, tool wear and sparking after a very short time of cutting. None of this trouble occurred when the relief angle was increased to 10 deg. To prevent chips from clinging to the cutter, a jet of compressed air, directed against the teeth as they leave the cut, was effective.

In the course of the tests, a total of 3000 sq in. of Zircoloy No. 2 was milled with a carbide cutter having eight teeth of a C-2 grade carbide. Cutting speed was 200 fpm, depth of cut was 0.060 inch, and feed was 0.010 inch per tooth. At this point, the cutter did not show more than 0.010-inch peripheral



Tool angles used in face milling of Zircoloy No. 2 zirconium alloy.

Power Requirements for Face Milling

Carbide Grade	C-50					C-2
Radial rake angle	+4 deg x 0.015 in. on +30 deg				−7 deg x 0.015 in. on +30 deg	−7 deg x 0.015 in. on +30 deg
Relief clearance angle, deg	6-10	8-10	10-13	12-15	4	4
	Net Horsepower					
SAE 1020 CR	0.511	0.510	0.512	0.534	0.643	0.632
Zircoloy No. 2	0.404	0.402	0.377	0.412	0.475	0.521
24 S-T aluminum	0.312	0.312	0.311	0.333	0.406	0.424
	Relative Horsepower*					
SAE 1020 CR	1.000	1.000	1.000	1.000	1.000	1.000
Zircoloy No. 2	0.790	0.789	0.737	0.773	0.739	0.824
24 S-T aluminum	0.610	0.612	0.607	0.623	0.631	0.670

*Compared with steel.

wear. If the workpiece thickness is over 0.200 inch, this amount of wear—and the heat it can generate in cutting—may not be objectionable. The workpiece will absorb about 12 percent of the cutting energy with sharp cutters. This can easily increase when the cutting tools become even slightly dull. If the zirconium workpiece is thin, the heat could cause considerable warpage and is, therefore, a factor which often requires a tool to be resharpened when the wear mark on the periphery has reached 0.005 inch.

The net power requirements for sharp cutters in milling Zircoloy No. 2 in comparison to SAE 1020 cold-rolled steel and 24S-T aluminum are given in the table above. These values were obtained in face milling with carbides and various rake and relief angles as indicated. It can be deduced that a relief angle of only 4 deg requires slightly more power for all materials tested. Approximately 15 percent increase in energy requirement can be ascribed to the change in radial rake angle from +4 deg to −7 deg. The remainder of this increase is due to the reduction in the relief angle.

Although a 4 deg relief angle usually will work satisfactorily in steel, with continued cutting it will shortly cause smearing in aluminum alloys and smearing—as well as sparking—in Zircoloy. Of course, the increase in peripheral interefence with growing flank wear will greatly increase the energy and power requirements above the small amount already observable in the table. In these tests, it was also found that the C-2 type carbide showed more of a tendency toward peripheral interference than did the C-50 type.

In slab milling with high-speed steel or carbide cutters, it was found advantageous to apply an ordinary water-soluble oil emulsion on the surface of the workpiece before the start of the cut. This prevented the chips from being carried around by the cutter and smearing or marring the freshly machined surface. Milling a recess with an interlocking herringbone set of slab mills was done on a production bed type milling machine with an automatic cycle. The main advantage of the automatic cycle arrangement is that it permits milling the recess without significant dwell of the cutter at entrance to and exit from the recess. Besides eliminating possible human errors in repetition of work accuracy, the dimensional repeatibility in the workpiece with the automatic cycle was satisfactory with regard to the length and depth of each recess and the positions of the recess relative to each other and to the end of the workpiece. From the standpoint of adequately holding relatively thin workpieces, it is advantageous to employ climb milling rather than conventional milling in slotting and slabbing cuts.

Test Results: The tests showed that Zircoloy No. 2 can be machined with tools generally recommended for machining high-strength aluminum alloys. This material is much easier to machine than some of the titanium alloys with which it is often compared. It does not have the tendency to alloy itself with the tool material which is pronounced with titanium alloys. The positive rake angles and large relief angles which can be used most effectively on Zircoloy did not perform well on 140A titanium.

Sharp unhoned tools, elimination of chips, avoidance of very fine chips in the cut and resharpened tools, after a small amount of wear is noticeable, are the most effective means of preventing any fires in the shop. Prudent use of an emulsion will help prevent clinging of chips to the tools and thus often improve the surface finish in milling.

When machining thin workpieces of Zircoloy, sharp positive-rake-angle tools are required to minimize the amount of heat generated by the cutting operation. An increase in flank wear will increase the amount of heat in the workpiece and thus the tendency to buckle or warp.

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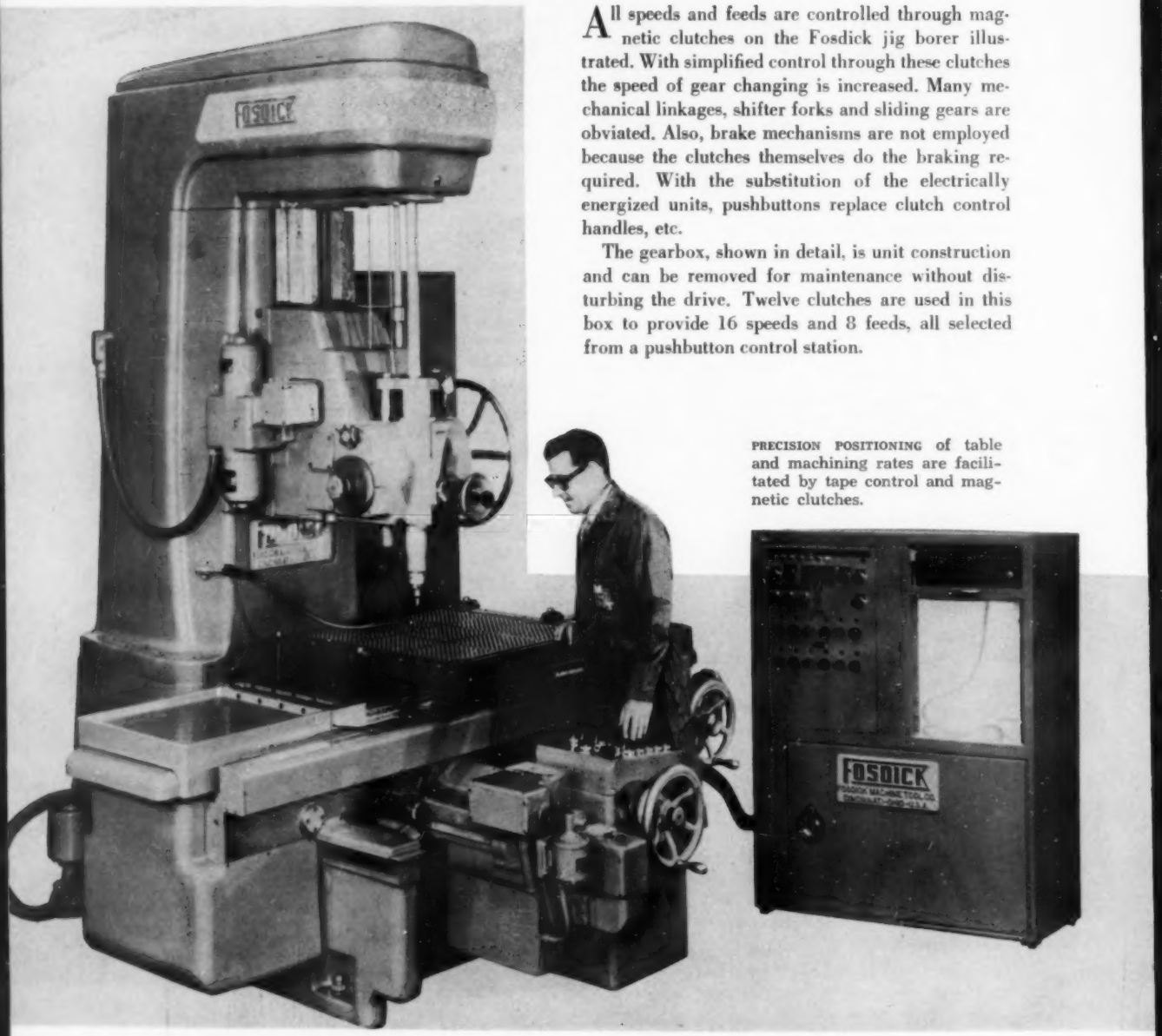
designed for

PRODUCTION

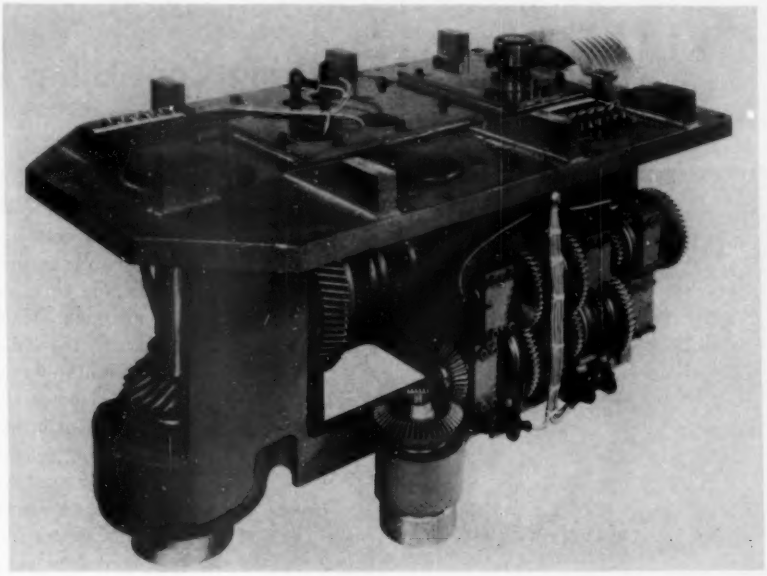
Electromagnetic Clutches Simplify Speed Changes

All speeds and feeds are controlled through magnetic clutches on the Fosdick jig borer illustrated. With simplified control through these clutches the speed of gear changing is increased. Many mechanical linkages, shifter forks and sliding gears are obviated. Also, brake mechanisms are not employed because the clutches themselves do the braking required. With the substitution of the electrically energized units, pushbuttons replace clutch control handles, etc.

The gearbox, shown in detail, is unit construction and can be removed for maintenance without disturbing the drive. Twelve clutches are used in this box to provide 16 speeds and 8 feeds, all selected from a pushbutton control station.



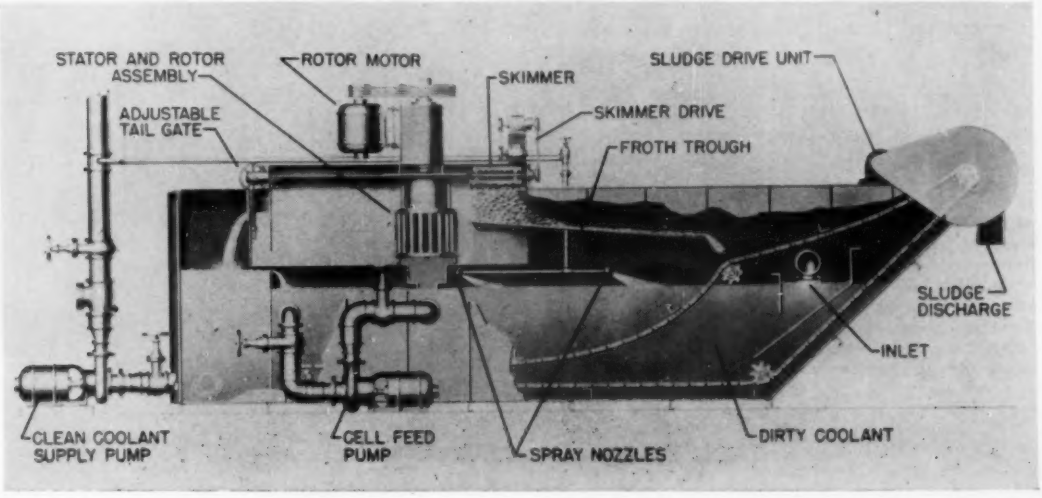
PRECISION POSITIONING of table and machining rates are facilitated by tape control and magnetic clutches.



GEAR BOX for jig borer has twelve magnetic clutches to aid in changing spindle speeds and feed rates. The clutches simplify design and control elements.

Flotation System Removes Sludge

Continuous, automatic clarification of water-soluble oil coolants, increases productivity of machine tools because down time due to failure of coolant supply and the need for sump cleaning are eliminated. In this flotation system, developed by U. S. Hoffman Machinery Corp., Industrial Filtration Div., contaminated coolant flows, by gravity, to the tank and is transferred to a flotation cell for aeration by the rotor-stator unit. Waste solids are held in suspension by froth and are skimmed off. Sludge is automatically removed in nearly dry form by a built-in sludge collector. Clarification of liquids is obtained mechanically without screens, filters powders or disposable media.



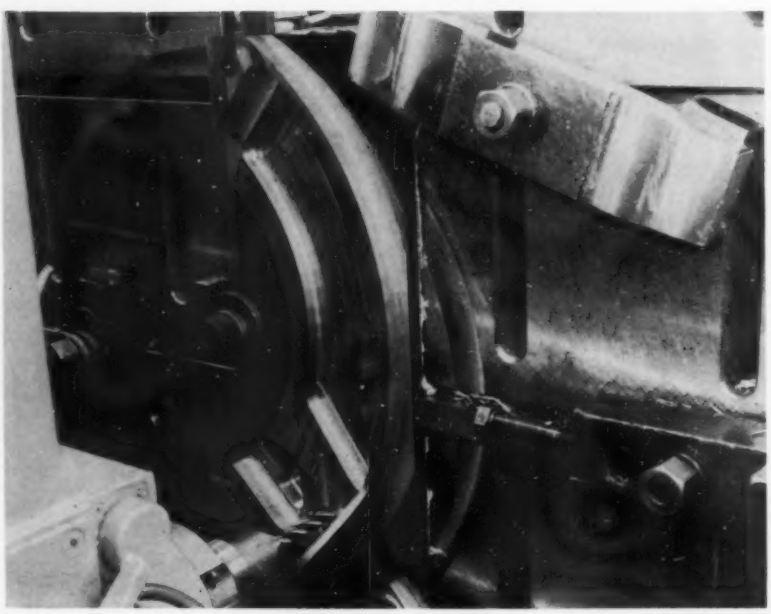
Automatic Contouring Controlled by Tape

TAPE CONTROL UNIT for Keller mill is conveniently located adjacent the mill. This unit feeds data to the machine, guiding the milling cutter in three planes.

This complicated tool-steel missile component is produced in one setup with three roughing and three finishing contour cuts plus four roughing and six finishing pocket milling cuts. The Pratt & Whitney Keller is tape controlled. Programmed tolerances are 0.005 inch for roughing and 0.0001 inch for finishing. Three-dimensional programming control is required in three areas; a combination of two radii and a slope on top of the rib, a similar cut on the side of the rib, and tapered cuts on two ribs. Total machining time on the part is 21.5 hours.

This three-axis machining with tape programming saves planning time and is equally versatile for short or long runs. Work including drilling, tapping and boring, as well as contouring on the mill may be performed to save the time of transferring to other machines.

The control unit, adjacent to the Keller, utilizes plug-in circuit panels as shown to facilitate maintenenance. Any number of programs may be stored on reels. Those for current jobs may be kept on the cabinet shelf for ready use.



COMPLICATED SECTION of missile component is produced by contour milling for both roughing and finishing cuts. Time schedules can be planned exactly with tape programming.

POSITIONAL TOLERANCING
cuts scrap losses

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Conventional bilateral tolerances can be interpreted in many ways. This leads to confusion as to the intent of the product designer and, often, the rejection of parts that would be functionally satisfactory. Positional tolerances make the design intent completely clear to tool engineers and gage designers, ending possible misunderstandings.

COMPANIES THAT DESIGN, manufacture and inspect their products in one location do not require a complete dimensioning system. Their designers are in immediate personal contact with tool and inspection departments and can constantly supplement product drawings with verbal instructions. Such personal guidance insures tool and gage compatibility, interchangeable parts and a final product that meets design requirements.

Companies with geographically separated design, manufacturing and inspection functions must rely almost entirely on product drawings. The designer may never be available for consultation. Incomplete product definition drawings, in this case, will cause disparity between drawings, production tooling and inspection equipment. These companies urgently need drawings that accurately present complete engineering information. Drawings using coordinate dimensioning systems are deficient in this respect, since they are incomplete, condone arbitrary inspection methods and even imply square tolerance zones that are impossible to gage precisely. Furthermore, gages designed to inspect bilaterally dimensioned parts consistently allow varying tolerances between part features and, as a result, often accept parts that would be rejected by open setup inspection. Decentralized companies are currently forced to supplement their drawings with excessive specifications, personal consultations and correspondence to stabilize design information.

Abstracted from Paper 225, "How Positional Tolerancing Clarifies Design Intent and Reduces Product Cost," presented at the 27th Semiannual Meeting. Copies of the complete paper are available for purchase from Society Headquarters.

Bilateral Systems

The bilaterally dimensioned plate, *Fig.* 1, has a rectangular pattern of four clearance holes. It will be assembled to an identical plate. Clearance hole sizes have been intentionally omitted. The designer wants to fasten both parts with four 0.500-inch diam bolts and insists upon 100 percent interchangeability.

Designing a gage to inspect this part is a real problem. Numerous starting points (datum) are possible. Some of these are:

The lower lefthand corner of the part
The intersection of any two edges
The bottom surface
Any corner of the part
The high points on the bottom surface
The high points on two surfaces
The center of the part
The lower left-hand hole
Any two holes.

The datum is determined by the personal preferences of the tool or gage designer. This is one of the

great weaknesses of the bilateral system. Four of the many possible gage designs are shown in *Fig.* 2. None of these designs uses the same datum and the actual starting point may vary drastically as the part varies in form. The datum should, of course, be a specific starting point for dimensions and measurements. If the part were located for machining with a fixture similar to Fig. 2*c*, however, and then was inspected with a gage similar to *Fig.* 2*d*, the datum might conceivably vary by 0.080 inch.

Most gage designers would subtract the total tolerance (0.020 inch) from the minimum diameter clearance hole to determine nominal gage pin size. Designers often specify clearance holes larger than actually needed hoping to increase part acceptance rates. However, as clearance holes increase in size, so do gage pins, since the gage designer attempts to check the hole location to the bilateral tolerance. The designer who merely opens up clearance hole size without also increasing the tolerance between the holes defeats his own purpose.

Fixed gages are more restrictive than open setup inspection. With a gage consisting of four fixed pins, an inspector would allow each hole center to fall within a 0.020 inch square tolerance zone, *Fig.* 3. Standard gage designs reject all hole centers that fall outside of a circular tolerance zone inscribed within

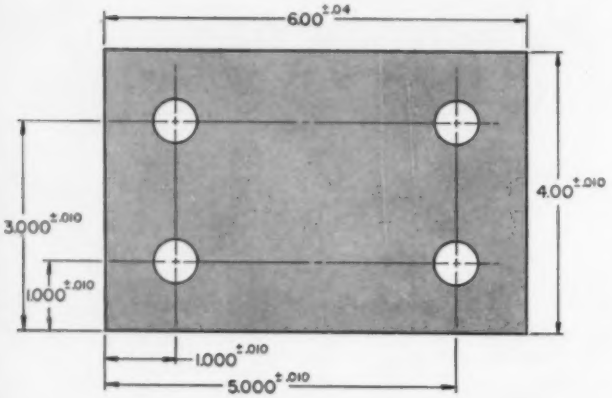
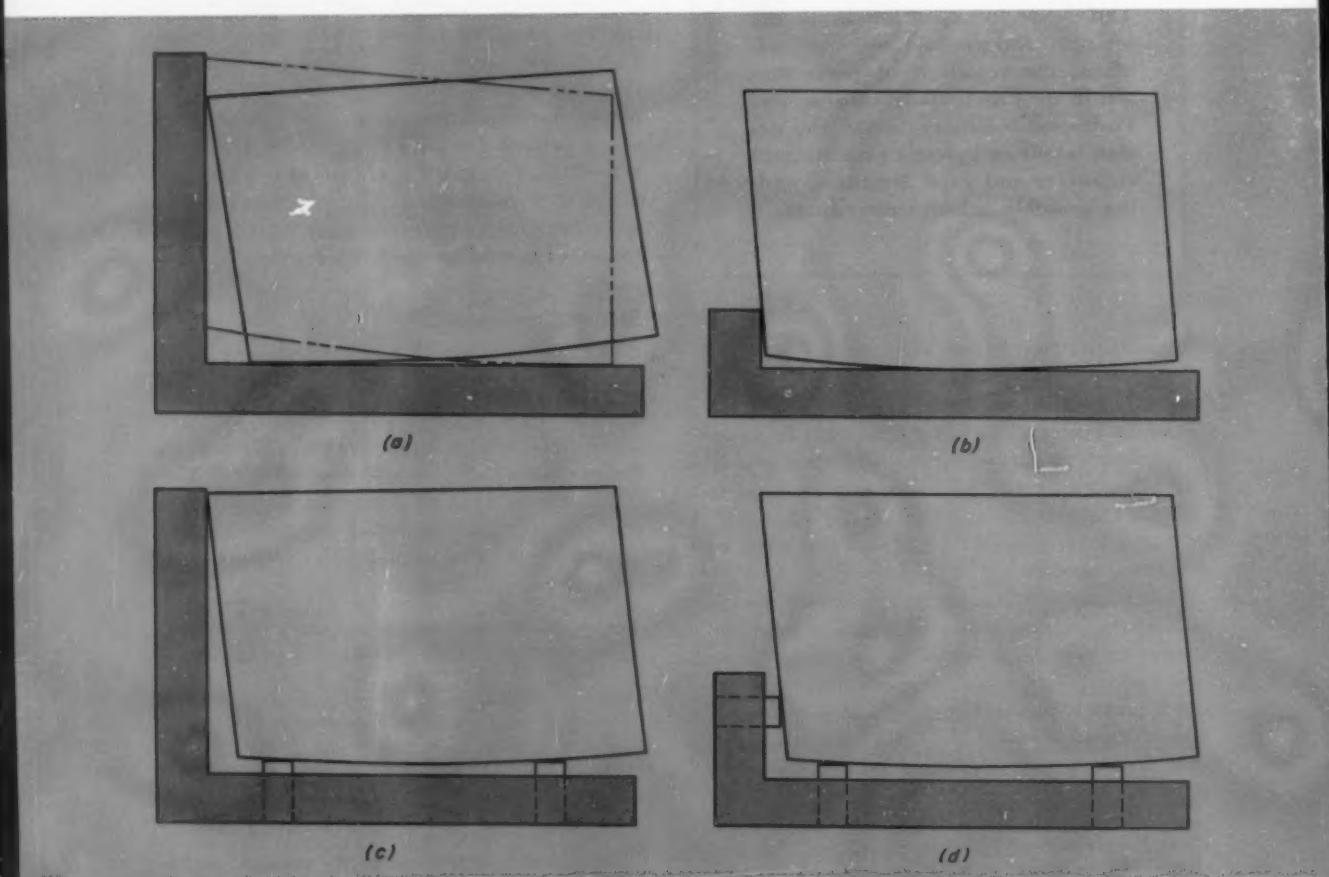


Fig. 1. (left) Bilaterally dimensioned plate. Selection of the datum (starting point) for gaging is left to the tool or gage designer.

Fig. 2. (below) Any of these gages might be designed to check the plate shown in *Fig.* 1, owing to the uncertainty as to the datum.



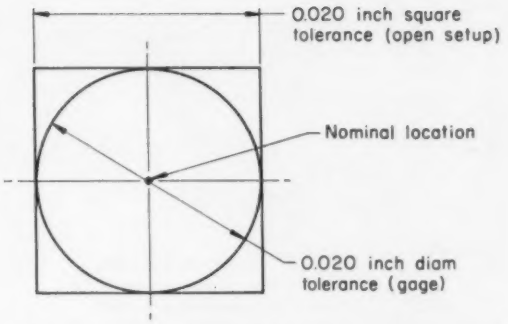


Fig. 3. Standard gage design rejects all holes that fall outside of a circular tolerance. Open setup inspection accepts any location in square.

the 0.020 inch square tolerance zone. This is proof that a fundamental disparity exists between gaging and open setup inspection within the conventional bilateral dimensioning system.

Positional Tolerancing

The tolerance zone diagram for the plate illustrated in *Fig.* 1 is shown in *Fig.* 4. Four 0.020 inch square tolerance zones are centered about four nominal locations. Since hole patterns on both parts are dimensioned and toleranced the same, the tolerance zone on both parts will coincide even though the part edges may not line up due to variations in form.

Coincident tolerance zones for two corresponding hole locations are shown in *Fig.* 5. The most critical condition of assembly will be when the centers of both clearance holes fall diagonally opposite each other at the extreme corners of their respective coincident square tolerance zones. A situation with hole centers falling diagonally opposite each other is shown in *Fig.* 6. Both holes shown are the same size and are, of course, larger than the bolt that will pass through them. If a 0.500-inch diam bolt can just be assembled through these two holes, it will be centered on the nominal location.

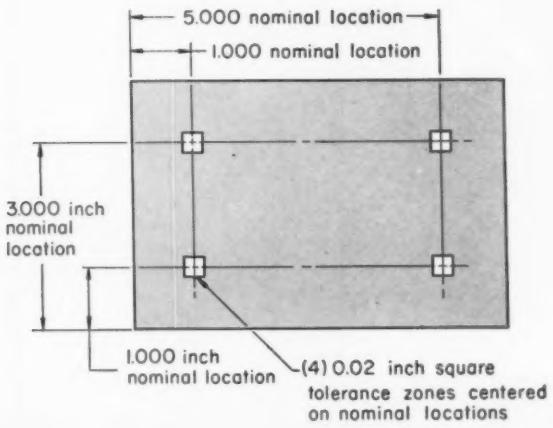
The diagonal of the square tolerance zone (0.028 inch) must be added to the bolt diameter (0.500 inch) and a 0.528-inch diam minimum clearance hole must be specified to insure 100 percent interchangeability. The bolt is nominally located at the most critical condition of assembly. This is the reason for nominally located gage pins.

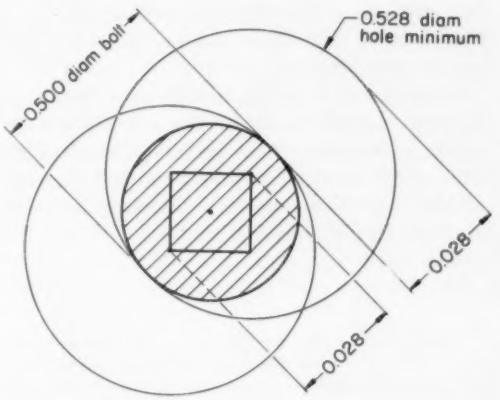
Since product drawings usually allow the manufacturer a tolerance on clearance hole size, a maximum size limit of 0.538-inch diam can be arbitrarily set for the four clearance holes. Oversize holes do not affect interchangeability. The clearance hole size callout will be: 0.528/0.538 diam, 4 holes. Two facts are clear at this point: Gages 0.020-inch diam smaller than minimum clearance holes are too re-

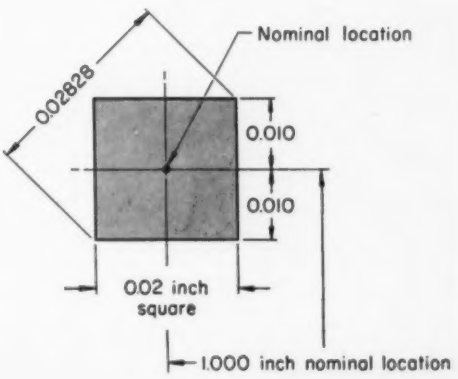
Fig. 4. (below) Tolerance zone diagram for plate shown in *Fig.* 1.

Fig. 5. (lower right) Coincident tolerance zones for two corresponding hole locations.

Fig. 6. (right) Diagonal of tolerance zone is added to bolt diameter (0.028 + 0.500 inch) to specify the minimum clearance hole (0.528 inch) which insures complete interchangeability.







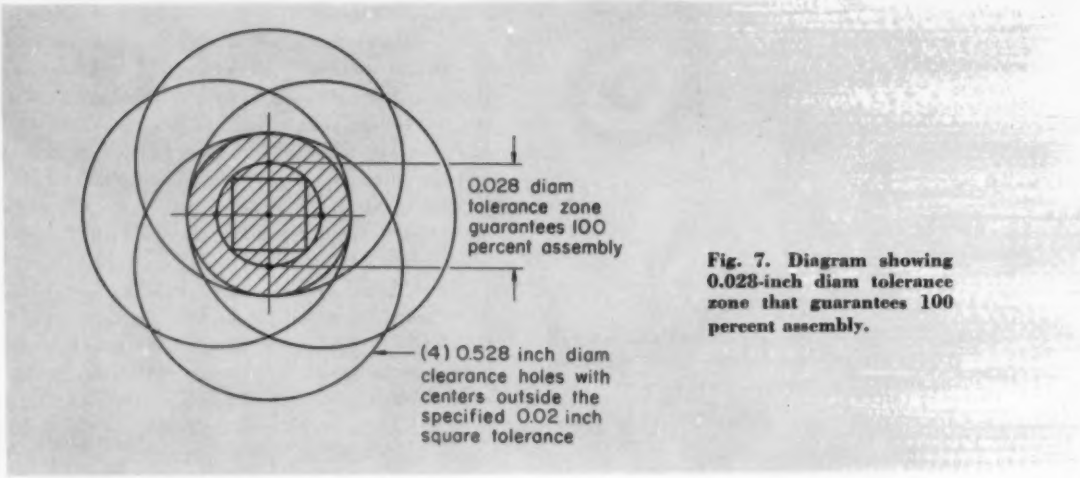


Fig. 7. Diagram showing 0.028-inch diam tolerance zone that guarantees 100 percent assembly.

strictive; and the larger-in-area square tolerance cannot be gaged.

Fig. 7 proves that both the 0.020-inch diam tolerance and the 0.020 inch square tolerances are too restrictive. There is actually a 0.028-inch diam tolerance zone. This zone is never specified on bilaterally dimensioned drawings. Clearance hole centers may fall outside the square tolerance zone and still not affect interchangeability. As long as the two clearance holes are no farther apart than 0.028-inch diam or 0.014 radius from nominal, the bolt will fit into the assembly.

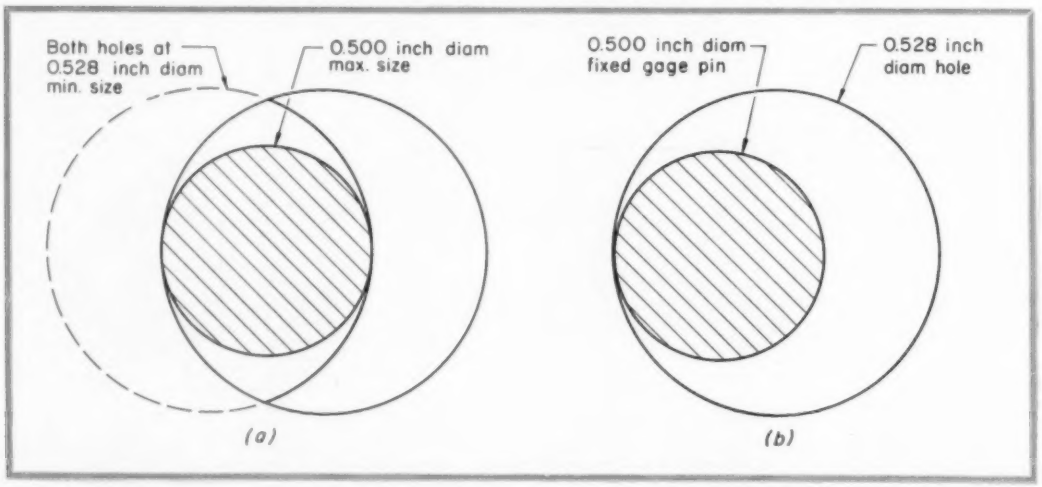
The positional tolerance formula for determining minimum clearance hole size (provided both parts contain at least three holes and are toleranced the same), is as follows: Add the positional tolerance specified to the bolt diameter to determine the minimum clearance holes in both parts.

Bonus Tolerances

The same critical condition of assembly illustrated previously by *Fig.* 6 is shown in *Fig.* 8*a*. This is a graphic representation of Maximum Material Condition (MMC)—the most critical condition of assembly. The internal features (holes) are at minimum specified size and the external feature (bolt) at maximum specified size. Both are critical. Odds are that the holes will actually be drilled close to nominal size (0.534 inch) by most manufacturers.

The condition shown in *Fig.* 8*a* is also illustrated in *Fig.* 8*b*, with one mating part removed, and the 0.500-inch diam bolt replaced with a 0.500-inch diam gage pin fixed on nominal location. Uusally only one part is gaged at a time. The actual difference between the gage pin (0.500 inch) and the clearance hole at MMC (0.528 inch) is the actual tolerance allowed (0.028-inch diam).

Fig. 8. Condition when hole is at minimum size and bolt is at maximum size (8*a*); and situation when bolt is removed and gage pin is inserted (8*b*).



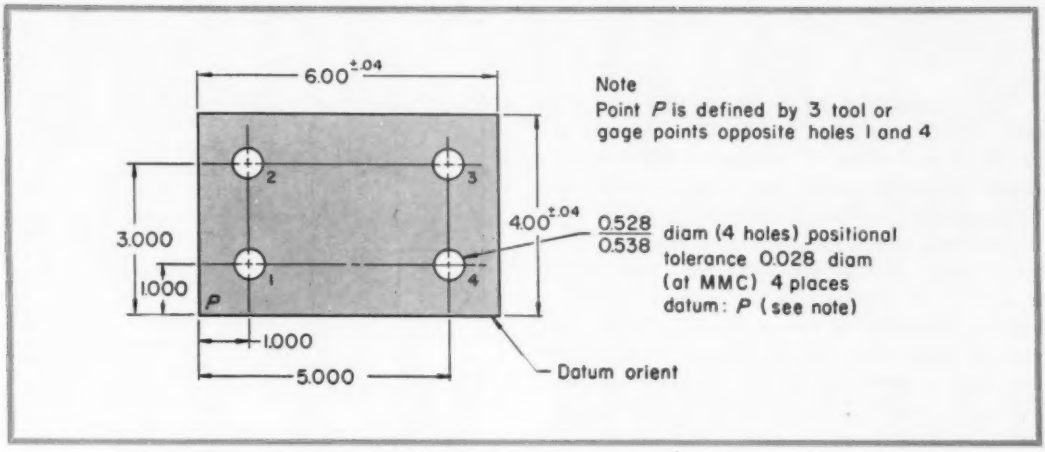


Fig. 9. Drawing dimensioned on the basis of positional tolerances.

If the actual hole size is increased to 0.538 diam (this is arbitrarily specified as the upper limit of its size), the difference between the gage pin and the hole is 0.038 inch. A 0.538-inch diam clearance hole may actually vary within a 0.038-inch diam tolerance zone and the gage will still accept the hole. The positional tolerance technology allows this bonus tolerance if the hole is not at MMC by specifying "at MMC" after the positional tolerance on the drawing. The increase in locational tolerance does not affect interchangeability.

A drawing based on positional tolerances is shown in *Fig.* 9. Inflexible bilateral tolerances have been removed from the nominal dimensions on the drawing and replaced by a variable but controlled positional tolerance.

Two important items are specified. The datum for measurement (Point *P*) has been specifically located by three tool and gage pickup points, and the datum for the direction of measurement from datum *P* (datum-orient) has been identified. The datum-orient is used to align the part in the gage and during open setup inspection. Both these datums may have to be physically marked on symmetrical parts, and are always specified to insure only one inspection method.

The drawing is a complete statement of design intent—clear enough to permit only one interpretation, as illustrated by the gage in *Fig.* 10. Gage pin size is directly determined on positionally toleranced drawings as the gage designer simply subtracts the positional tolerance (0.028-inch diam) from the clearance hole size at MMC (0.528 inch diam) to determine his gage pin size (0.500 inch). No guesswork is needed; the gage pin size is actually specified on the drawing.

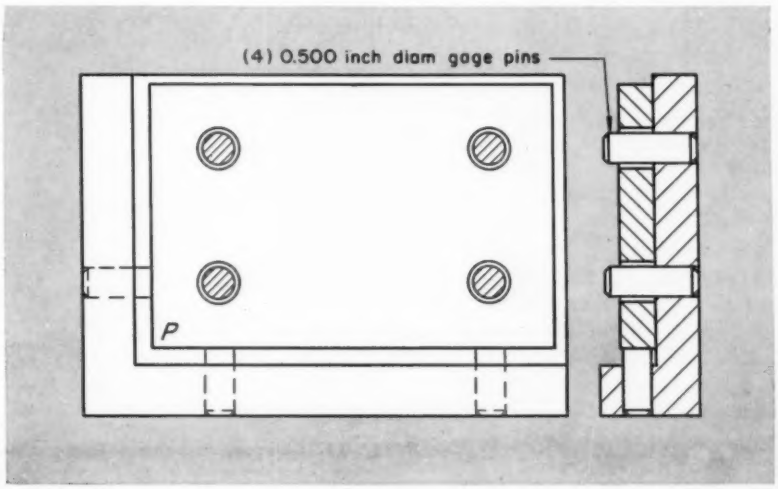
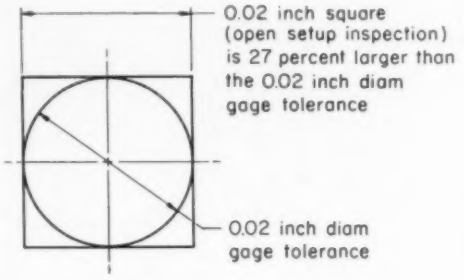
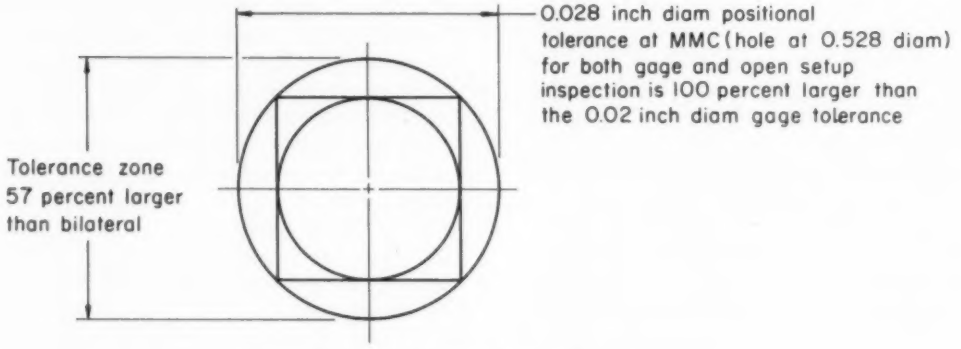


Fig. 10. Gage designed to inspect part from the datum shown in *Fig.* 9.

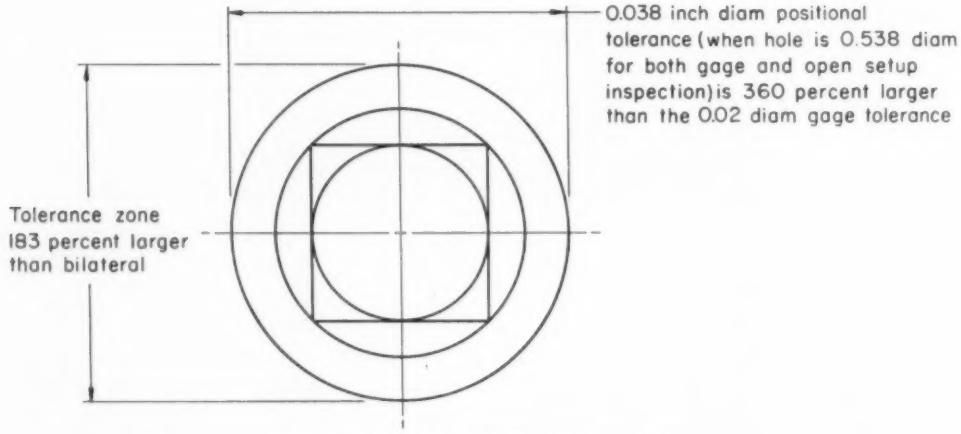
The bilateral and positional dimensioning systems are compared in *Fig.* 11. The tolerance increase allowed (from 57 percent to 360 percent) should justify the use of positional tolerances for any company currently dimensioning parts with bilateral tolerances. The cost reduction possibilities are obvious when the number of good parts being scrapped each day because of incorrect and ambiguous dimensioning is considered. Further advantages accrue from the obviation of complicated liaison procedures in interplant manufacturing activities. Among them, the reduction in lead time is paramount.



BILATERAL TOLERANCE


0.028 inch diam positional
tolerance at MMC (hole at 0.528 diam)
for both gage and open setup
inspection is 100 percent larger than
the 0.02 inch diam gage tolerance
Tolerance zone
57 percent larger
than bilateral

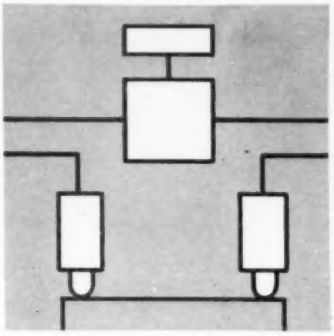
POSITIONAL TOLERANCE AT MMC


0.038 inch diam positional
tolerance (when hole is 0.538 diam
for both gage and open setup
inspection) is 360 percent larger
than the 0.02 diam gage tolerance
Tolerance zone
183 percent larger
than bilateral

POSITIONAL TOLERANCE NOT AT MMC

Fig. 11. Comparison between bilateral and positional tolerances. Tolerance zones are much larger for positional tolerances than for bilateral.

INSPECTION and DECISION by electronics



By David R. Houck*
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With the continuing demand for smaller tolerances and faster inspection methods, electronic gages are coming into their own. A working knowledge of the capabilities of these fast, extremely accurate gages is essential to their successful applications in industry.

INDUSTRY'S DEMAND for component parts having closer dimensional and physical property tolerances has created a need for faster, more reliable and more versatile inspection methods. These requirements are stimulating the use of electronic inspection and decision-making methods. Although it may not be necessary for tool engineers to understand the theory of the electronic circuits involved, they should understand the capabilities of electronic inspection methods.

There are several widely used electronic systems for obtaining dimensional measurements; the functions of the elements used, such as, sensing and gaging elements, are fundamentally the same.

Sensing elements are often referred to as "displacement transducers." The most commonly used types are the differential transformer and the variable capacitor. A variable capacitor element is shown in *Fig.* 1. For practical purposes, the sensing element can be considered a gaging stylus that is displaced by any dimensional variation in part size, or by the amount of motion of the surface it is contacting.

The electrical change caused by the displacement of the sensing element is transformed into a usable signal for deflecting the pointer of a meter or for operating electronic limit switches by the gage circuit. The principal advantage of a system that has a variable capacitor as its sensing element is that its gage circuit has an extremely high output voltage, which can be used directly without intermediate multistage amplifiers. This output voltage varies from 10 to 30 volts over the effective range of the circuit and is linear with respect to the displacement of the variable capacitor sensing element.

The gage circuit and the sensing element actually form an electronic inspection system within themselves as they accomplish the measurement of part size. Displacement of the pointer of the gage circuit meter can be visually interpreted to obtain a size reading. A standard commercial recorder can be connected to the gage unit to give a visual indication of size. However, other elements are necessary in making automatic decisions from the electrical information supplied by the sensing element and gage circuit. The most frequently used element is the electronic switch. This element can be considered a limit switch which, rather than reacting to mechanical motion, is energized by an electrical signal of a specific magnitude from the

Abstracted from paper 231, "Parts Inspection and Decision Making by Electronics," presented at the 27th Semiannual meeting. Copies of the complete paper can be purchased from Society Headquarters.

***Senior member ASTE Detroit chapter.**

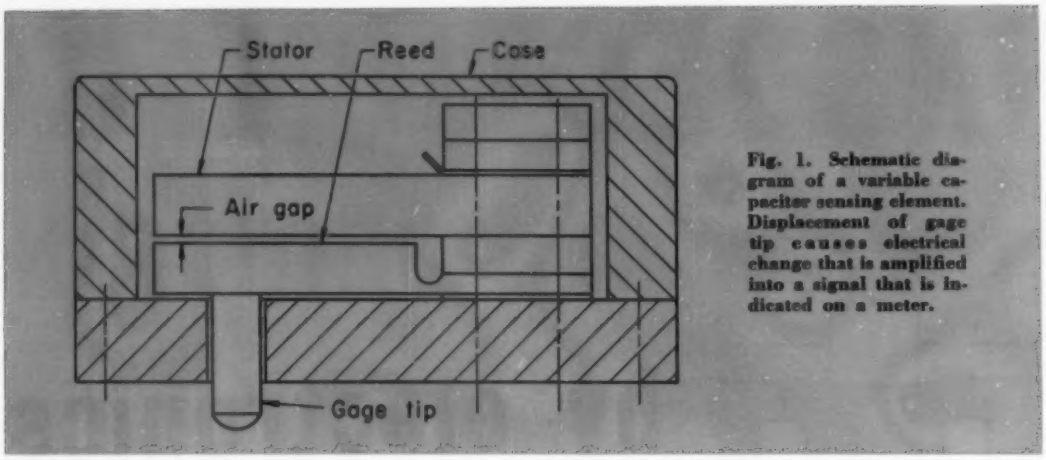


Fig. 1. Schematic diagram of a variable capacitor sensing element. Displacement of gage tip causes electrical change that is amplified into a signal that is indicated on a meter.

gage circuit. Variable capacitor systems employ thyratron tubes as the switches. These tubes are set to fire at a preset voltage value and energize a relay which can be used to operate a light, bell, or an electrically actuated sorting mechanism. The switch is connected to the output of the gage circuit and will fire when the output voltage of the gage reaches the preset voltage value.

Since the output voltage of the gage is the indication of part size, the switch can be set to fire at a predetermined dimension. When parts are to be sorted into undersize, acceptable, and oversize categories, two electronic switches are used. The first switch is set to energize its relay at the low tolerance limit and the second switch is set for the high limit. A part which does not cause the gage to operate either switch is undersize. If only the first switch is actuated, the part is within the acceptable tolerance range. If both the first and second switch are actuated, the part is oversize. By the use of a chain of switches, parts can be sorted into any number of categories for selective fitting during assembly.

Other extremely important elements in the decision-making portion of electronic inspection systems are the computers. These are of two types: the sum computer, which is used for adding the output signals of two gage circuits and the difference

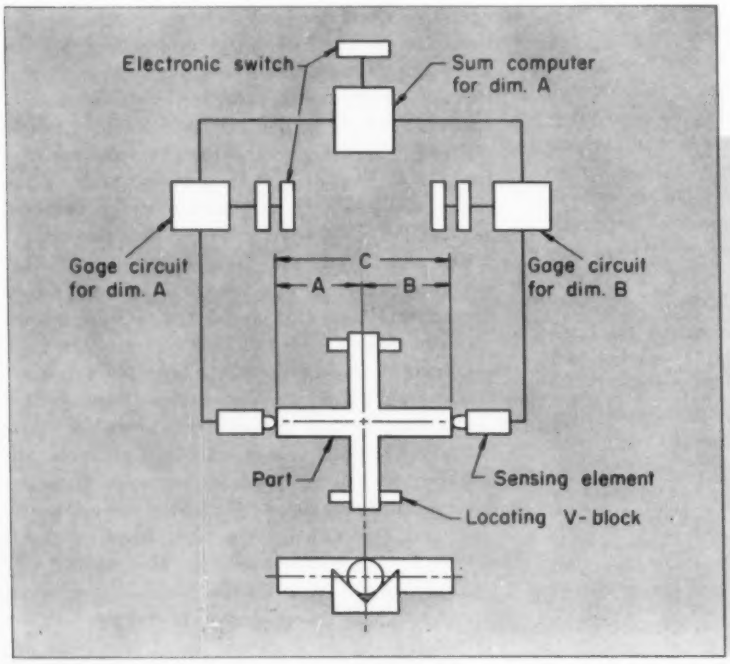


Fig. 2. Inspection of three critical dimensions in a universal joint cross. Gage units measure lengths "A" and "B"; sum computer adds these values to obtain length.

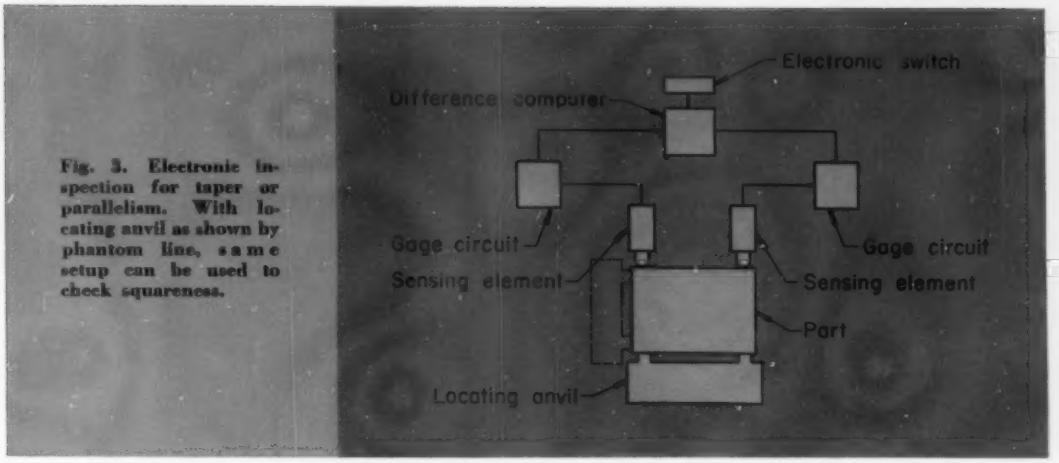


Fig. 3. Electronic inspection for taper or parallelism. With locating anvil as shown by phantom line, same setup can be used to check squareness.

computer which is used for subtracting the output signals of two gage circuits.

Computer elements can be combined in a variety of ways to determine almost any measurable dimension and even some physical properties. For example, the over-all length of one cross member of a universal joint cross, *Fig.* 2, and the length of each of its segments relative to the centerline, can be determined by the use of two gage circuits and a sum computer. A gage unit is used to measure the length of each of the two segments, and a sum computer adds these values to obtain the over-all length. To measure the width and parallelism of a rectangular part, *Fig.* 3, two gage circuits are used to measure the ends, and a difference computer then determines parallelism. If the part is out of parallel, the direction of this deviation is determined by whether the difference reading is plus or minus. This capability is used in the inspection of automotive pistons where taper is allowed in one direction only.

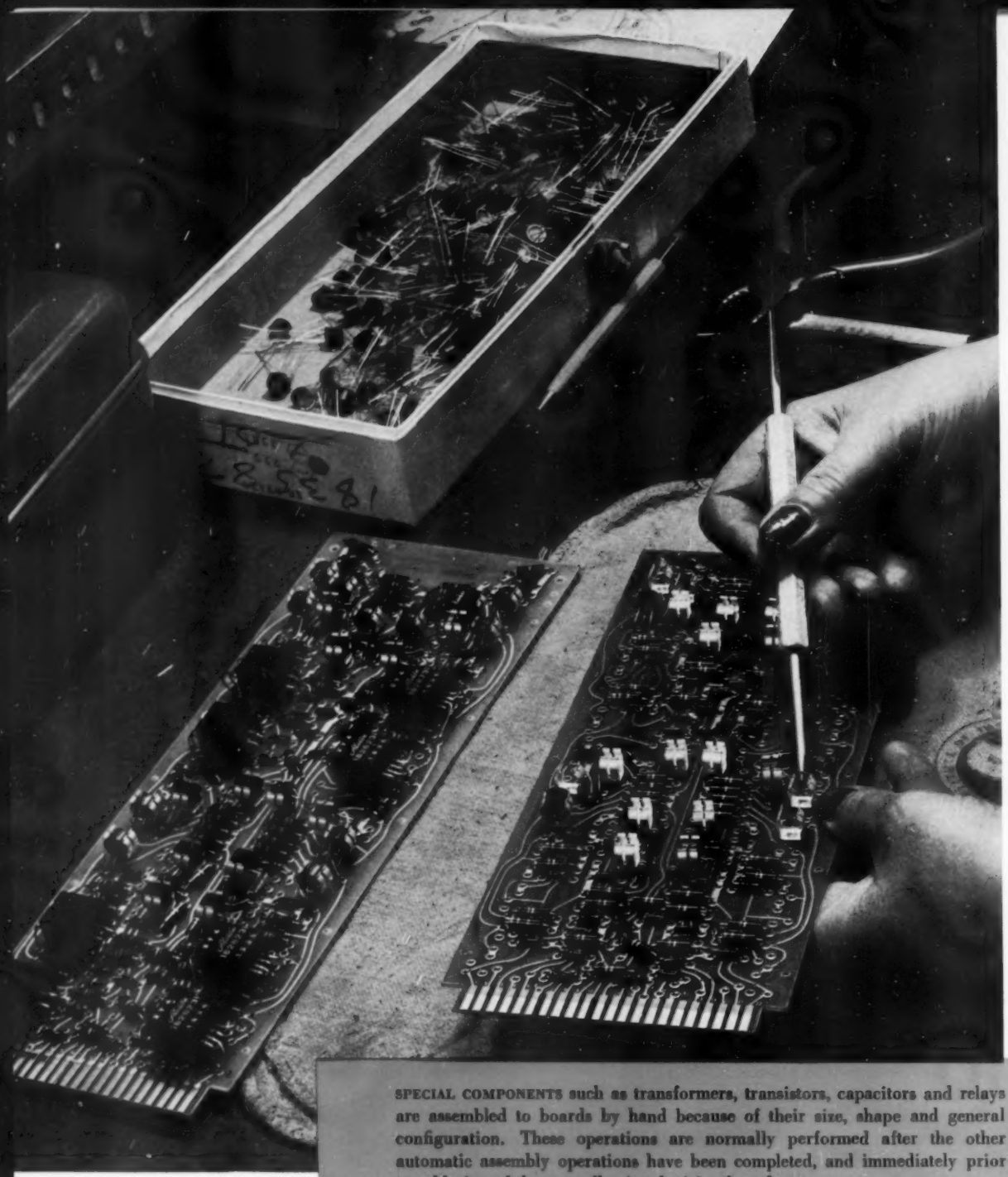
Inspection of surface hardness and weight can also be accomplished by the use of electronics. An accepted method of measuring hardness of a surface is to measure the penetration of an indentor under a specified load. By the use of a sensing element to measure the travel of the penetrator, a gage circuit, two electronic switches and appropriate sorting mechanism, parts can be automatically segregated into categories of too soft, acceptable and too hard.

Weighing can be accomplished by measuring the deflection of a beam. The restoring force of a spring can be determined in the same manner. Out-of-roundness and concentricity can be measured by gage circuits modified so as to react to a change of reading only, so that the actual diameter size of the surface being measured does not influence the final answer.

While any of the above inspection problems can, in many cases, be solved with the use of pneumatic or electrical gaging techniques, electronic methods offer several major advantages, one of which is increased speed. Since the time required for an electronic gaging system to resolve an answer is negligible, the inspection rate of an electronic inspection and sorting system is limited only by the time required for the mechanical motions involved in moving the parts to and from the gaging fixture. Some typical inspection and sorting rates of automatic machines using electronics are: diameter inspection of bearing rollers (15,000 parts per hour); hardness inspection (4000 parts per hour); out-of-round inspection (3000 parts per hour); and weighing (6000 parts per hour).

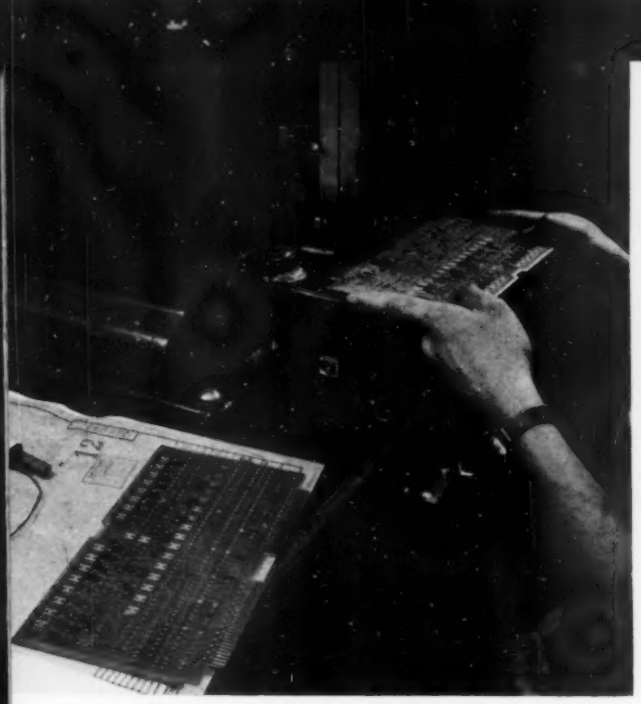
Other major advantages of electronic inspection methods are their greater sensitivity and accuracy. Under ideal laboratory conditions electronic gage circuits can be used to indicate dimensional variations in size as small as 0.000002 inch. When properly applied, electronic gaging and segregating methods can be used on automatic machines for accurately checking and sorting parts having dimensional tolerances as small as 0.000020 inch.

Today's electronic inspection methods enable industry to handle measurement problems which were impossible until a few years ago. In the past, tolerances and dimensional variations have been measured in thousandths of an inch, but today measurements of a millionth of an inch are not uncommon. It is also evident that modern electronic inspection and decision making methods are rudimentary when measured against the demands of tomorrow. Aircraft, missile and satellite components of the future will be manufactured with more stringent dimensional and physical property tolerances than are now required. The Space Age is moving rapidly to its fruition and tool engineers who wish to keep pace will find a working knowledge of the fundamentals of electronics mandatory.



SPECIAL COMPONENTS such as transformers, transistors, capacitors and relays are assembled to boards by hand because of their size, shape and general configuration. These operations are normally performed after the other automatic assembly operations have been completed, and immediately prior to soldering of the over-all printed wiring boards.

TOOLS at work

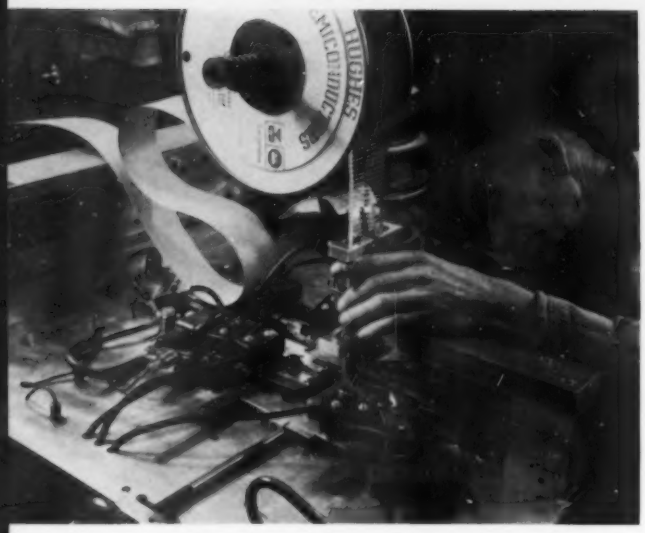


HEART OF AUTOMATED ASSEMBLY LINE is a battery of special machines which insert various sizes of eyelets. The eyelets serve as receptacles for electronic component leads. Five automatic eyeletting machines are capable of performing 60,000 operations per single shift. Eyelets range in size from 0.048 to $\frac{1}{8}$ inch and are usually copper or brass.

THREE OF THE SPECIAL DYNASERT MACHINES feed and insert the electronic components into printed wiring boards. These boards are the main operational elements of electronic computers. The machines trim the lead wires of the components to correct size, insert them through the boards, bend the leads to secure the components until they can be soldered. Automatic feeds separate the components and align them for assembly. An automatic magnetic fixture holds each board in the correct position for accurate component insertion.

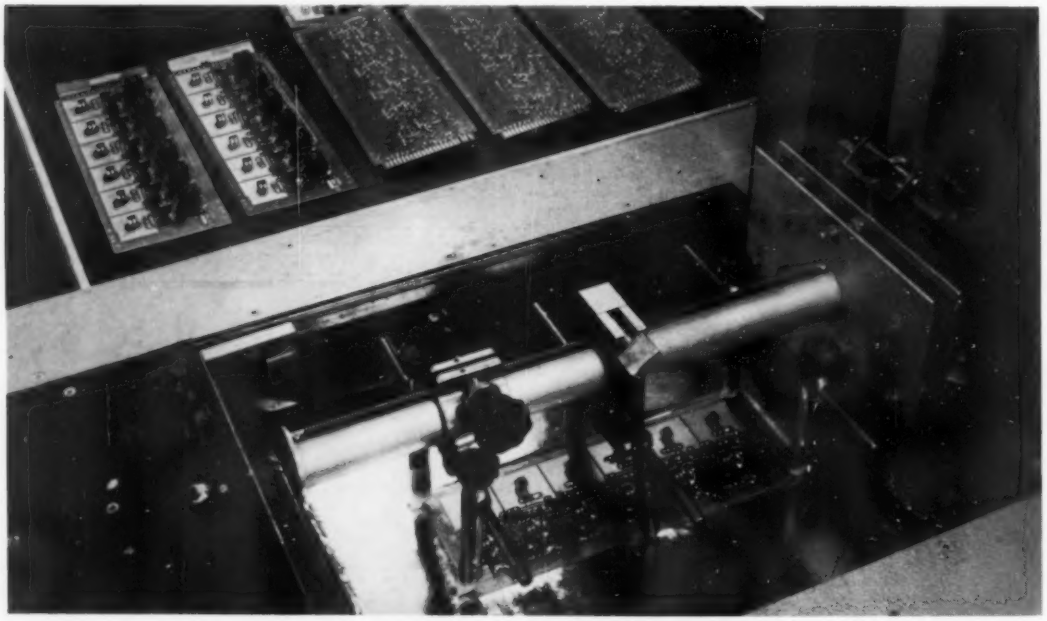
AUTOMATIC COMPONENT ASSEMBLY LINE. A special lead forming machine is in the foreground. Development of the special fixtures and machine attachments on the automatic assembly line have made possible the high-speed production with an actual increase of precision over the former manual methods. Much of this special equipment was designed by Librascope engineers.

Much of the circuitry used in today's electronic "brains" is in the form of printed wiring board assemblies. Large numbers of these assemblies, produced to exacting standards of quality and reliability, are needed in each computer. Librascope Inc. of Glendale, Calif., has developed semiautomated assembly techniques to supplement manual assembly. The result has been faster assembly and improved product reliability of digital computers and other electronic products.



PREFORMING OF COMPONENT LEADS has been automated where certain manual assembly practices must be followed. Components are fed into the machine by a hopper and gravity feed or in strip form. They are automatically sorted and aligned, then leads are cut to size and shaped to the required pattern for hand assembly and insertion.

WHEN BOARDS are removed from the solder-dip station, they are hand-brushed to remove the excess solder and inspected. A hot detergent bath and rinse removes all traces of flux, grease and other contaminants. A detailed inspection insures that there are no soldering defects before the assembled boards are installed in computers. Shown in the rinse operation is a completed board.

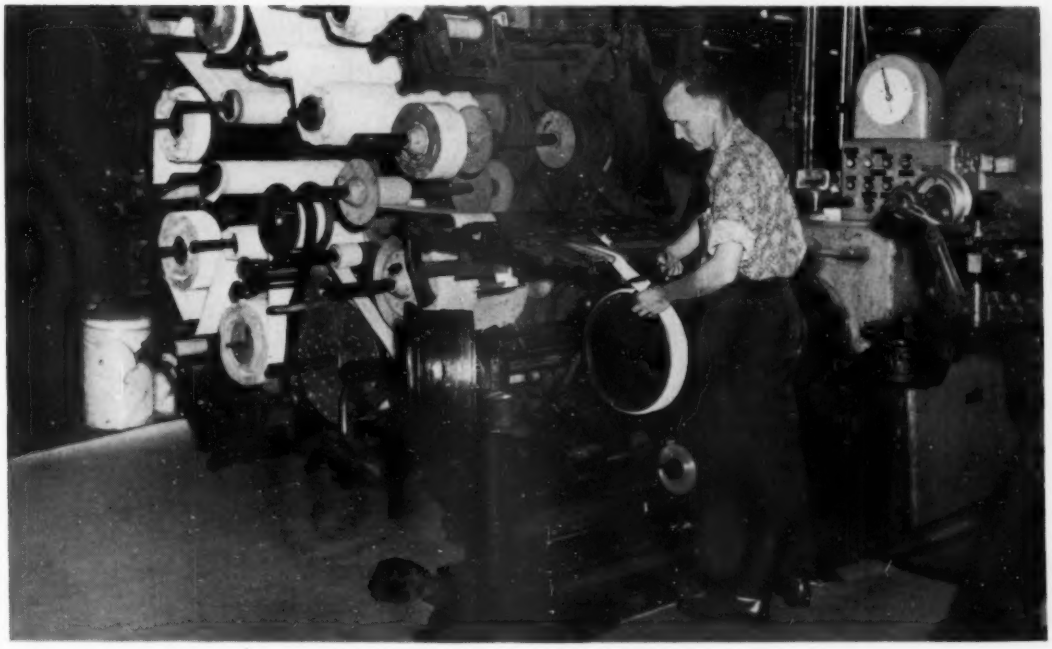


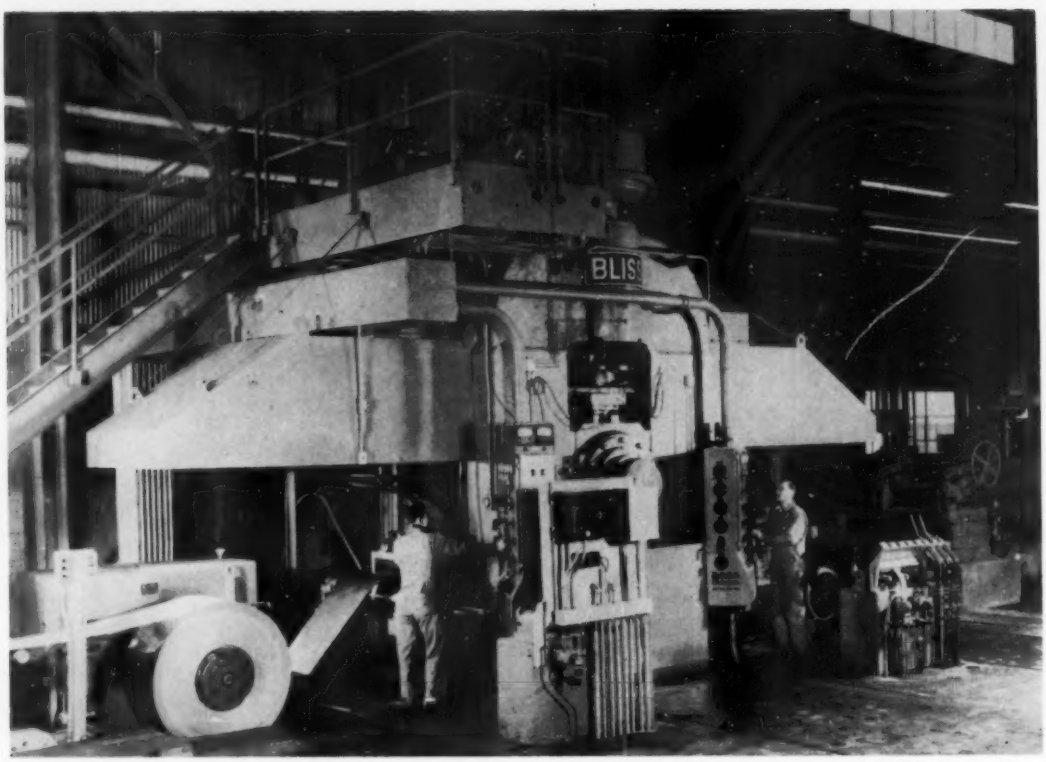
THE FINAL STEP in the automatic assembly sequence in soldering components into place. Each board is coated with a maskant to prevent liquid solder from adhering to parts that do not require it. The boards go to a flux dip, then to an infrared preheating station that eliminates moisture and brings the board to a temperature compatible with the molten solder. Here, at the dip-soldering station, the boards are gripped by a series of fluoro-plastic fingers and dipped for a four-second cycle. The average temperature of the solder is 470 to 490 F. This temperature may be raised for heavier solder deposits.

SEAM of stainless steel water softener tank is welded at the rate of 40 ipm on Linde automatic welder at General Ionics Corp. Tank material is Allegheny Ludlum Type 302 stainless steel. Type 308 filler rod is fed from variable-speed wheel at upper right. Lincoln ST-100 flux is used with submerged arc.

TOOLS at work

USING A NEW TYPE TIRE BUILDING MACHINE, a worker at the B. F. Goodrich Los Angeles tire plant attaches the white sidewall to an embryo tire. Electronic control with nearly 200 vacuum tubes, reads a punched tape which supplies machine directions. Eighteen manual building operations have been eliminated with the machine. By changing tapes and making a few mechanical adjustments, the machine can be set to build many different types of tires.





PRECISE CONTROLS on this four-high reversing mill permit reduction of stainless steel strip to thicknesses as small as 0.012 inch. It processes coils weighing up to 18,000 lb at speeds up to 1000 fpm. This mill is part of a new Universal-Cyclops stainless steel strip plant in Coshocton, Ohio.

TOOLS at work

TWO-HIGH TEMPER MILL at Universal-Cyclops imparts lustrous surface to stainless steel strip and insures correct hardness. Powered by a 350-hp drive, this mill handles 18,000-lb, 24-inch coils.

Weight reduction through tolerance control

By George A. Hoffman
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Aero-Astronautics Dept.
The Rand Corp.
Santa Monica, Calif.

Additional manufacturing operations to obtain closer tolerances on sheet materials make it possible to lighten the weight of aircraft and rockets, giving improved performance. The author gives a formula for determining the manufacturing cost of obtaining these closer, more economic, tolerances.

SHEET DESIGN in flight-vehicle structures is governed by two factors: proper choice of a material with certain minimum properties, and specification of the configurations and gage thickness.

Designers usually assume, conservatively, that most portions of the sheet possess the minimum properties guaranteed by the mill producer. Likewise, they are apt to specify tolerances on the sheet gage in such a manner that the thinnest sheet used equals or exceeds the nominal design thickness. Tolerances may be defined as the largest deviations from the nominal thickness of the sheet within some prescribed confidence level, usually between 0.90 and 0.95. While both practices result in small additional margins of safety, both add extraneous weight to the structure.

In specifying tolerances of sheets for use in aircraft and missiles, one is confronted with conflicting alternatives. A liberal tolerance reduces purchasing costs and speeds delivery of the desired sheets. A tight tolerance, on the other hand, raises costs but helps to reduce extraneous weight.

The present study develops a criterion by which the problem of tolerance specification can be solved. The method is based upon measuring both the ex-

traneous weight and the additional cost as functions of the tolerance, in this way permitting a direct relation between the increased manufacturer's cost and the weight reduction from tightened tolerances. Identifying the manufacturer's cost with the worth to the customer of the weight saved determines a range of "most economical tolerances" for most materials and gages.

Extraneous Weight

The method of calculation used in this study is applicable to most sizes, gages and types of flight-vehicle sheet materials. For the sake of simplicity and as an illustration of possible applications within the titanium sheet-rolling program,[1] calculations are shown in this section only for titanium sheets with dimensions of 0.063 x 36 x 96 inches. Results for aluminum, steel and beryllium in a variety of gages are tabulated in a later section.

The extraneous material (i.e., the material beyond the thickness required by the design) in a manufactured sheet results from two types of deviation from the "perfectly" dimensioned flat sheet:

a. Variation in the thickness of the sheet along the rolling direction. This variation is experienced from sheet to sheet and also, to a lesser extent, within a sheet. Its occurrence is due to variations in the material properties at the rolling temperature and to imperfections of the rolling machines.

b. Variation in the thickness of the sheet perpendicular to the rolling direction. Sometimes this variation results in thin edges and a high center, called a crown. It is directly attributable to the design of the rolling mill. Lately, improved sheet fabricating methods have eliminated much of the crown, although random variations may occur across the width of the sheet which are comparable to those along the rolling direction.

The additional overweight resulting from using standard stock gages instead of the design-required thickness is not considered here, although it may represent a penalty as high as seven percent of primary structural weight.

The overweight per square foot of sheet can be obtained from the formula:

$$S = (0.5)^2 \ (T) \ (144) \ (D)$$

where S = overweight per square foot of sheet, T = total magnitude of tolerance, and D = density. Total magnitude of tolerance is maximum thickness minus minimum thickness. The factor 0.5 accounts for randomness of actual gages within the permissible tolerance of sheets in fabrication and above the minimum design thickness. This factor is squared to account for randomness parallel and perpendicular to the rolling direction. The number 144 is obtained by dividing square inches by square feet. Density is 0.67 lb/cu in. for beryllium; 0.101 lb/cu in. for 7178 aluminum; 0.162 lb/cu in. for 6al-4V titanium; and 0.276 lb/cu in. for 17-7 PH steel. Sheet overweights due to thickness tolerances are shown in *Fig.* 1.

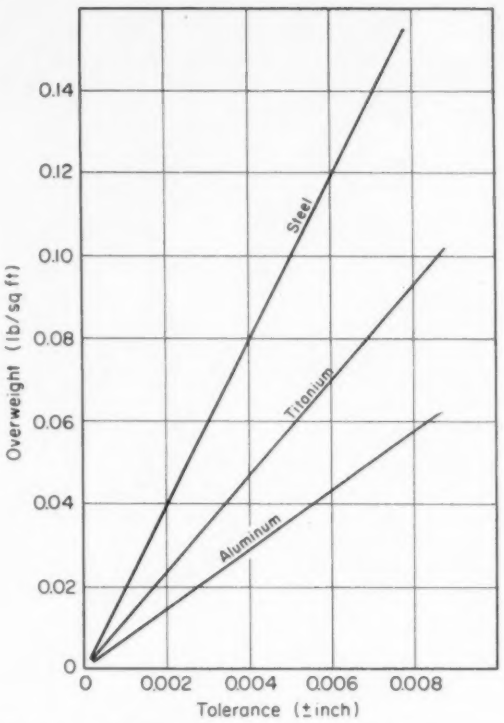

Fig. 1. Sheet overweights increase with the increase in thickness tolerances.

Cost of Tightened Tolerances

Deviations from the required thickness of sheet can be held to a minimum by a number of methods. A few of these, listed in the order of successively higher cost increments over commercial tolerance sheets, are:

1. "All-over" inspection of sheets rolled to commercial tolerances (± 0.006 inch for 0.063 gage), retaining possibly one-half of the sheets with the best tolerances and reprocessing the remaining worse half. This procedure finds many precedents in the large-scale scrapping of aluminum and titanium in aircraft production. By judicious inventory of these gaged-all-over sheets, tolerance may be reduced to ± 0.002 inch for 0.063 gage by selecting the best-dimensioned half of the sheets.
2. Rolling in special high-precision mills specifically designed to produce very accurate thicknesses. Such mills might yield 0.063-gage sheets with ± 0.001-inch tolerance.
3. Sheet and plate skin grinding down to ± 0.0005 inch in special mills (which are still in the design stage).

Approximate cost increments will be calculated for these three processes applied to a 0.063 x 36 x

[1]References are listed at the end of the article.

96-inch titanium sheet. Costs are estimated on the high side and in 1959 dollars, and are to be interpreted only as an illustration of the method.

Reprocessing: The incremental cost in dollars per square foot for reprocessing sheets above ± 0.002-inch tolerance is calculated as follows: (8.5—4.0) (0.063) (144) (0.162) = $6.5/sq. ft. Here, 8.5 = cost of rolled sheet in dollars per pound.[2] One pound is discarded as too thick for each pound used. The figure 4.0 = re-use value of discarded sheets (original value minus reprocessing costs such as gaging, grinding, polishing, etc.). Multiplying (0.063) (144) (0.162) = 1.47—the weight (lb) of 1 sq ft of 0.063 inch thick titanium sheet. Cost of inspection, gaging, and handling should be well under one dollar per sq ft.

The cost of obtaining ± 0.002-inch tolerances by reprocessing sheets happens to be about the same as the cost of skin rough-grinding down to ± 0.002 inch. Thus (0.30/0.001) (0.012 — 0.004 + 0.010) = $5.5/sq ft, where 0.30 = cost of grinding 0.001 inch from one sq ft of titanium, 0.012 — 0.004 =average thickness to be ground off (obtained by subtracting the tolerance after grinding from the tolerance before grinding and doubling the result); and 0.010 = average thickness of available sheets minus desired average thickness.

High-Precision Rolling: A special mill—presently in use for other metals—would have to be utilized to roll titanium sheet to ± 0.0010-inch tolerance. Such a mill, estimated to cost $6,000,000, might be in use only half the time for titanium. The incremental cost in dollars per square foot will be of the order of:

$$\left(\frac{6{,}000{,}000 \times 1.2}{12} + 100{,}000\right)(0.5)\left(\frac{1.47}{30{,}000}\right) = \$17/\text{sq ft}$$

where 6,000,000 = installed cost of mill, building, etc., in dollars; 1.2 factor for upkeep, repair, replacement, utilities, etc.; 12 = time period (years) of linear depreciation with zero resale value; 100,000 = cost to operate mill, in dollars/yr; 0.5 = utilization factor for titanium; 1.47 = conversion factor for sheet, lb/sq ft; and 30,000 = weight of titanium sheet that might be rolled in peak year, with industry pooling use of one mill.

This cost of $17/sq ft is high compared to the prospects of finish-grinding as-delivered sheets to ± 0.001-inch tolerances. There are indications from present experiments that production grinding to such accuracy is feasible and might tentatively cost about $12/sq ft for 0.063-inch sheet titanium.

Skin Grinding and Polishing: Polishing mills capable of ± 0.0005-inch production accuracy on titanium are yet to be designed. Tentative estimates have been made that the cost of achieving ± 0.0005-inch tolerances may be double that of obtaining ± 0.001-inch tolerances. These costs are shown graphically in *Fig.* 2. The curves for aluminum and steel were obtained by similar calculations and from actual industrial experience.

Criterion for Tolerances

It has been shown (*Figs.* 1, 2) that both cost and overweight can be functionally related by cost analysis to the same variable-tolerances. It is now possible to relate the additional purchasing cost to the tolerance overweight in sheets, as in *Fig.* 3.

If an index or figure of merit were somehow devised for the value to an aircraft or missile operator of eliminating one pound of overweight, then it would be possible to read off directly from *Fig.* 3 the "optimum" tolerances on any thickness and type of sheet material.

There is a great range of opinion as to the worth or value to an aircraft operator of a pound of weight saved. A list of some of these estimates and their sources may indicate the width of these divergent opinions:

> The figure of $2065/lb has been mentioned for a commercial piston-engine transport.[3]
>
> The figure of $600-800/lb has been derived for an American jet transport.[4]
>
> Correspondingly, figures of $560-840/lb have been used for a British jet transport,[5] $220/lb for a fighter-interceptor,[6] and $98/lb for a British prop-jet transport.[5]

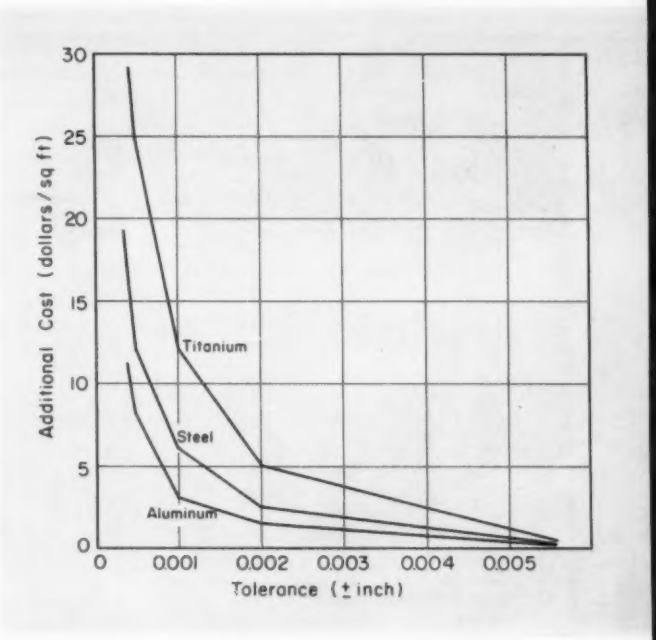

Fig. 2. Addition cost included in tolerance control of 0.063 x 36 x 96-inch sheets.

Space vehicles are most sensitive to extraneous weight. From experience it cost about $30,000 to place one pound of payload into orbit in Explorer I, and about $15,000/lb for Explorer IV.[7]

Because of this spread in estimated values, rays from $50 to $1000/lb are plotted in *Fig.* 4 for the worth of weight reduction in flight structures.

A criterion can therefore be formulated: For a wide range in the worth of a pound, there is only a narrow spread in the economically optimum tolerance. As an example, in the range of $200 to $500/lb saved, *Fig.* 4, aluminum and steel tolerances on 0.063-inch sheet can be specified to be ± 0.001 inch, while titanium tolerances appear to be between ± 0.0015 and ± 0.002 inch. The accuracy of these economically optimum specifications is within ± 50 percent of their mean value in the range from $200 to $500/lb.

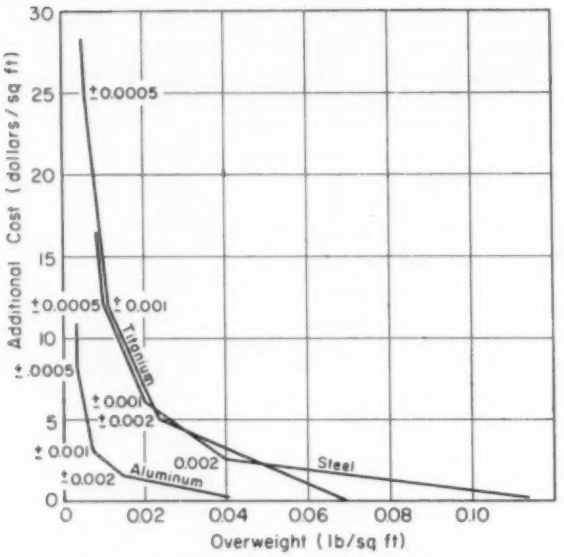

Fig. 3. Relationship between additional purchasing cost and overweight in sheets. Cost increment is shown linear between indicated tolerance points.

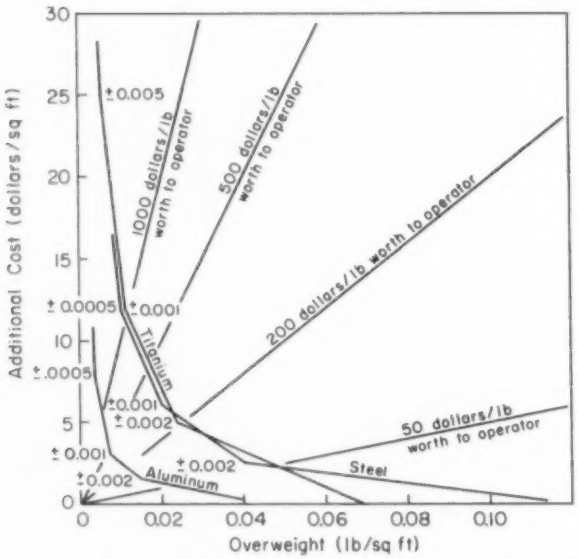

Fig. 4. Rays indicating dollar-to-pound value have been added to *Fig.* 3 to determine optimum tolerance.

Target Tolerances: It should be remembered that the plots in *Fig.* 4 and the desirable tolerances for steel and aluminum (± 0.001 inch) and titanium 0.063-gage sheet (± 0.002 inch) are sensitive to the annual production quantities of each material. This sensitivity becomes more apparent when one notices that the incremental cost of high-precision titanium sheet is inversely proportional to the pounds per year produced. Therefore, if the planned yearly poundages of titanium are revised significantly upward or downward, target tolerances should accordingly also be revised, but in the opposite sense. The result is that if the 30,000 lb/yr production figure is raised, for example, to 100,000 lb/yr, the optimum tolerance would be reduced to ± 0.001 inch. On the other hand, if the 30,000-lb/yr figure is lowered to 10,000 lb/yr, then the tolerance would go up to ± 0.003 inch.

One should also notice the trend for incremental cost to vary with gage thickness, all other factors remaining constant. The result is that if the major portion of titanium sheet produced is not in the 0.063-inch gage of *Fig.* 4, but is in the 0.032-inch gage, for example, then the optimum tolerance would be reduced to ± 0.0015 inch. There is a growing demand for sheet in increasingly thinner gages. In sandwich type panels, the face sheets will be much less than half the gage of equivalent sheet-stringer designs; furthermore, thin titanium foil will be needed for honeycomb or corrugated core.

In summarizing these various possibilities, as shown in the table, the following assumptions were made:

The value to the vehicle operator of reducing one pound of overweight is $100/lb.

Aluminum and steel sheet production is measured at approximately present-day levels.

Titanium sheet may be produced at anywhere from 30,000 to 100,000 lb/yr.

Production of beryllium sheet may be hypothesized at from 10,000 to 50,000 lb/yr.

Tabular entries are shown for 36-inch wide sheets and are on the low side for much wider sheets.

The main conclusion of this study is apparent from the table; namely, that the economically optimum tolerances of all sheets of all materials are consistently smaller than those readily available at present in the aircraft and missile industry. It should be of major concern to realize that, in all

Optimum Tolerances of Sheets for Various Thicknesses and Production Levels*

Sheet Thickness (inch)	Beryllium 10,000 lb/yr	Beryllium 50,000 lb/yr	Titanium 30,000 lb/yr	Titanium 100,000 lb/yr	Aluminum† Optimum	Aluminum† Commercial	Steel† Optimum	Steel† Commercial
0.002	0.0003	0.0002	0.0002	0.0002	0.0002	0.0003	0.0002	—
0.020	0.0015	0.0012	0.0015	0.0010	0.0007	0.001	0.0008	0.002
0.063	0.0050	0.0030	0.0030	0.0020	0.0020	0.004	0.0020	0.006
0.125	0.008	0.005	0.006	0.004	0.003	0.005	0.004	0.010
0.250	0.012	0.008	0.009	0.006	0.005	0.013	0.005	0.017

*Tolerances shown in inches.
†At present production levels.

instances, sheets used in flight vehicles today are overweighted by excessively loose tolerances.

Finally, this analysis serves to point out that expenditures constitute a design factor influencing structural weight in the manner of the more commonly studied factors, such as the configuration of structural elements and the material used.[4] For example, a sufficient expenditure increase when purchasing sheets could reduce structural weight by 3.6 to 5.3 percent in a titanium sheet structural component. (If the design thickness were 0.056 inch, commercial sheet would have to be procured at 0.063-inch gage, ± 0.006 inch. The percentage of reducible overweight would then be:

$$100\left(\frac{0.006 - 0.004}{0.056}\right) = 3.6$$

where 0.004 inch is a tolerance purchasable at a reasonable cost. Where 0.003 inch is a tolerance purchasable at some moderately high cost, the percentage is:

$$100\left(\frac{0.006 - 0.003}{0.056}\right) = 5.3$$

Value Increment: Consider the aluminum structure of a modern jet transport aircraft such as the one described in Reference 8. According to the table, tolerances between ± 0.0020 and ± 0.0007 inch should be specified, at additional costs up to $2/sq ft of surface. If this cost at first seems unduly high, the economics of the weight reduction may be illuminating. There are upwards of 10,000 sq ft of sheet and plate in such a transport, with a weighted commercial (average) tolerance of ± 0.006-inch reduction to, say ± 0.0015 would save 650 lb.

This 650 lb saved permits capacity to be increased in one model from 88 to 90 passengers by simply installing two more seats in the already-designed transport. But the worth to the operator now has increased from the initial cost of $4,500,000 per airplane to 90/88 ($4,500,000) = $4,600,000, assuming that the airplane always operates at capacity. The $100,000 increment in value, divided by the 10,000 sq ft from which it is derived, gives a worth of $10/sq ft, or well above the $2/sq ft worth originally paid out to increase the value. The worth of a pound saved in this instance is $100,000/650 lb, or about $154/lb.

Structural weight reductions of this order merit the close scrutiny of the customer, especially in cases where a high monetary value can be assigned to each pound of extraneous weight. His manufacturing program need not change, but his purchasing schedule should be altered and remain flexible enough to obtain optimum tolerance. Though his initial expenditure may be higher, this additional expense is more than compensated for by evaluating the reduction of extraneous weight.

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automatic DIE SINKING

By T. W. Black
Senior Associate Editor

Experience at one company has demonstrated the feasibility of tape-controlled die sinking. The program was initiated by the Air Force to investigate the potential for tape-controlled die sinking. Inherent advantages are higher accuracy, greater repeatability and reduced machining time. Improvements in programming methods may lead to general adoption of this method.

DURING THE PAST SEVERAL YEARS, numerical control of contour milling operations has reached a high state of development. Thousands of production parts have been successfully produced by this new technique. Now that the ability of numerically controlled machines to give high performance on production parts has been amply demonstrated, a number of companies are investigating the possibilities of numerical control for die sinking.

One of these companies is Wyman-Gordon, a manufacturer of precision forgings for the aircraft industry. Although the typical production run is small at this company, a large variety of forgings is produced and total production is high. This volume and variety of parts results in requirements for large numbers of dies.

The majority of larger dies used in the plant are produced on tracer machines, working from wood or plaster models. While this method unquestionably gives satisfactory results, preparation of models or templates can take scores or hundreds of hours of skilled work. Lead times from receipt of an order until completion of a die model may be many weeks. Speeds and feeds used during tracer-controlled die sinking are, to a large degree, left to the discretion of the machine operator. Understandably, most operators are extremely careful when machining a die block that may have cost several thousands of dollars. Despite this care, there is always a possibility of human error. Much of the potential productivity of the machine is lost due to the need for slow, careful work, frequent stops for checking while a job is in progress and the need to make frequent changes in feeds and speeds.

While the theoretical ability to make a series of identical dies from one master at different times is good, variations in machining practices can make identical duplication difficult. Minor variations occur and these must be corrected by hand finishing.

These were some of the considerations that led Wyman-Gordon tool engineers to investigate the possibility of numerically controlled die sinking. Use of a control tape, rather than a complex die model, seemed to offer potential savings in both the cost of the model and in lead time.

There were, however, a number of unknowns concerning tape-controlled die sinking. The first question dealt with engineering and technical manpower. None of the engineers in the plant had any direct experience with numerical control, nor did any of the available technicians have any training in the maintenance of electronic machine controls.

A second problem was economic. With the installation of any new method or machine, the question "Will it pay?" is all-important. While dispensing with die models offers a direct cost saving, preparation of a control tape—and the training of engineers to program die sinking operations on tape—can be costly. Further, little was known about potential maintenance costs and the actual results that could be obtained by tape-controlled die sinking. Conventional die-sinking methods, on the other hand, had at least the advantage of being a proved technique that gave predictable results.

Other problems typical of conditions that are faced by most companies that are considering numercial control, involved the lack of a computer and tape preparation equipment, to say nothing of the electronic testing equipment and spare parts necessary to keep a control system operational.

In the absence of specific cost and performance data, it was decided to develop numerical-control

a progress report

techniques on an experimental basis. This work, which started in late 1957, has been carried out with the cooperation of the Air Materiel Command, which is working in a similar manner with other plants. A Kearney & Trecker profiler, equipped with a Bendix numerical control, has been used for development work, *Fig.* 1.

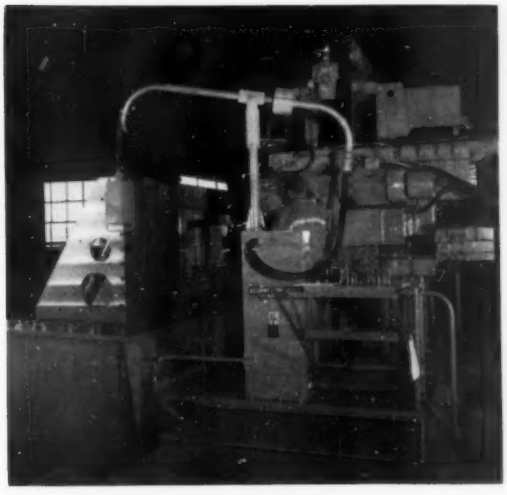
Initial Training: At the outset, management recognized that training of personnel in an utterly new technique could not be accomplished overnight. It was also recognized that correction of "bugs" in a new machine and a new control system would also take time. Further, as personnel were being trained, they would be developing suitable procedures for applying numerical control to die sinking—a field which was almost entirely new to industry. Consequently, the introduction of numerically controlled die sinking was established as a long-range program, with no pressure for immediate results.

Selection and training of personnel was the first step in the program. Capable engineers and technicians from the product engineering, plant engineering, and electrical and hydraulic maintenance departments, plus supervisors from the die shop, formed the core of the numerical control group. Members of this group, which is semiautonomous, have the responsibility of putting the numerical control program into effect.

These men attended the Bendix Operator's School for several weeks. Most members of the group were unfamiliar with the language of numerical control, but they quickly learned the transition in thought from the decimal system to binary numbers, and from length, width and thickness dimensions to *X*, *Y* and *Z* coordinates. When the group returned from the school the members held several discussion periods to review the knowledge they had gained.

Members of the group worked on the installation of the profile milling machine and thus became generally familiar with the components of the machine and the control system. Concurrently with the installation of the machine, group members developed process sheets for the machining of a Wyman-Gordon name plate and, after attending an intensive course in programming at Bendix, were able to develop process sheets for an experimental die block, *Figs.* 2 and 3.

Experimental Block: This die block was designed to provide a good test of the capabilities of numerical control for die sinking work. The shapes involved in the die impression call for profile milling of the outside flanges and pad extensions, pocket milling the center boss, profile milling the cross ribs and pocket milling the web surface. Two rela-



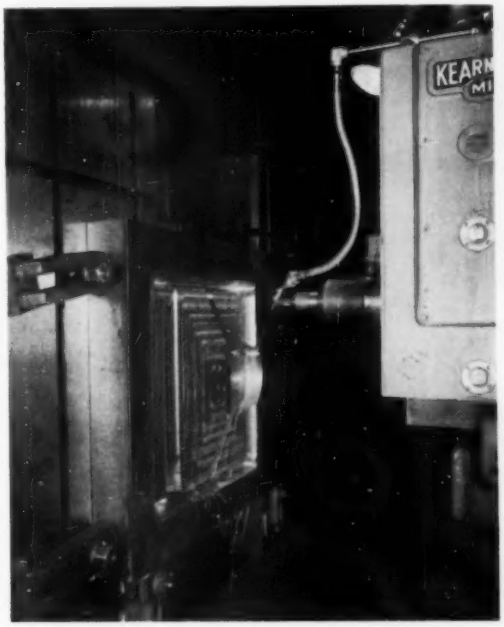


Fig. 2. First automatically machined die block.

Fig. 1. (left) Profiler used for experimental die sinking work. It can also be used for production parts.

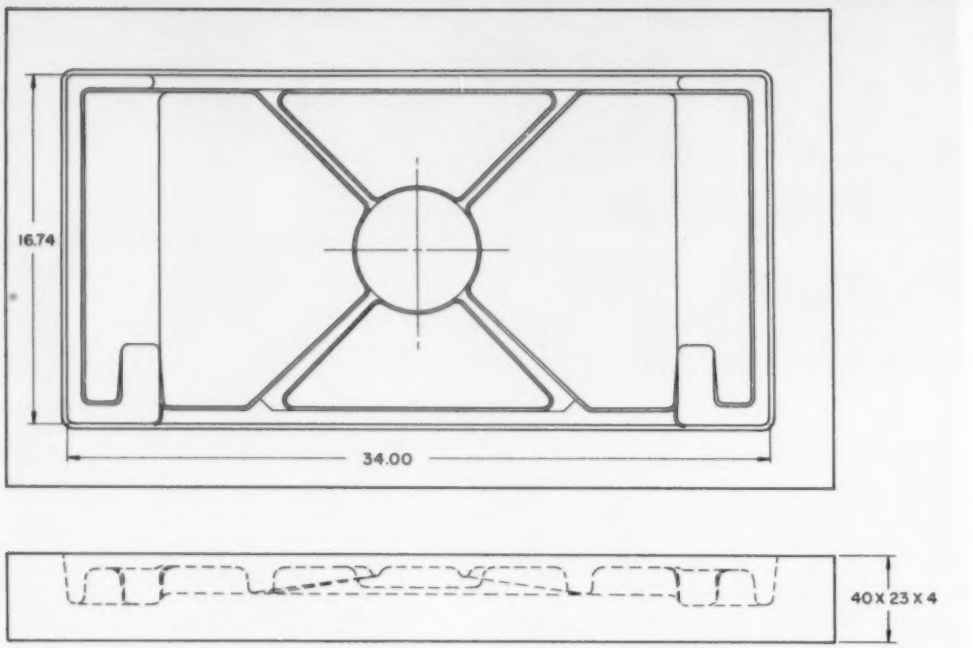


Fig. 3. (above) Although this die design appears fairly simple, the long, thin ribs, which taper in the plan view, give a good test of numerical control.

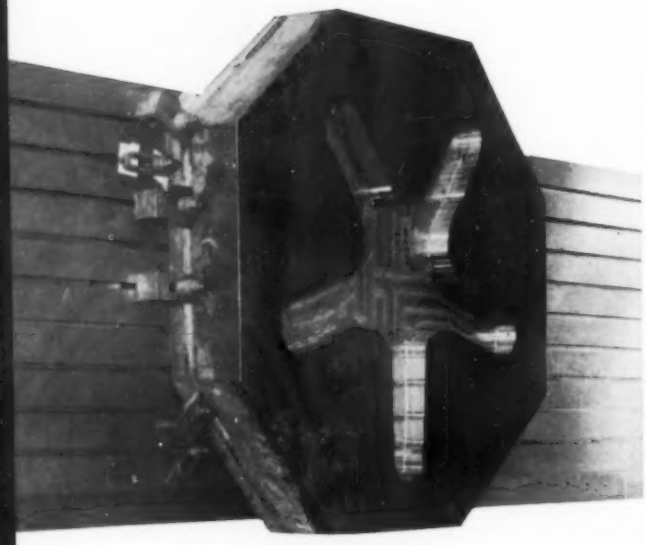


Fig. 4. (left) Bottom die block. This was the first actual production die machined by numerical control.

tively thin (0.25 inch) ribs were provided so that the depth of rough cut passes and feed rates could be evaluated. These ribs taper only in the plan view. Cutter center offsets are required in the *X-Y* plane while the *Z* (depth) axis is constant during machining. Two other ribs have a taper in the plan view. The depth of these ribs changes along their length. This rib construction means that the tool moves at an angle in the *X-Y* plane as well as at an angle to the die face. There is also a round hole in the cavity, which is described as a circle in the *X-Y* plane with a constant *Z* dimension.

After completion, the process sheets were sent to the Bendix control tape center where a computer was used to develop the machining program and "print" it on a control tape. Curves were developed with a Bendix COMPAC-01 computer subroutine.

Production of the experimental die block was the first real run-in of the machine tool and control unit. The whole operation was handled as experimental work to provide operator and programmer training. Several minor programming lapses were discovered when the control tape was directing the machine. Some cutter overlap was not programmed, so ridges were left in the finished piece. Transition movements from area to area were slow; consequently the machine was "cutting air."

A few cutter breakages occurred due to excessive feed rates. It was possible to prevent such damage by using the feed-rate override on the control. Feed rates had been made higher than normal as part of the experimental work, to determine optimum cutting speeds. Actually, the cutter breakages served as valuable operator training, since he gained experience in the resynchronizing of tape and tool when repositioning and starting up the unit near the point of cutter breakage. This served to teach the operator the use of reference points on the control tape and the operation of the position indicator on the control. Comparative times for die sinking by the conventional method and by numerical con-

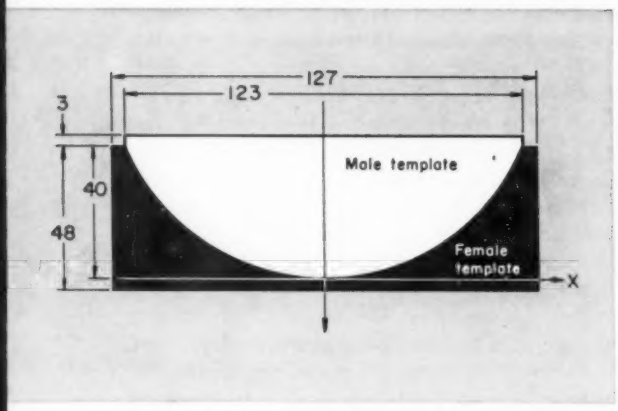


Fig. 5. Parabolic templates were cut to accuracy of ±0.003 inch by numerical control, demonstrating the accuracy of the equipment.

trol were 44 hours versus 159.5 hours. Actual machining time for the conventional method was 30 hours as compared to 24 hours under numerical control. The major difference between the total times for the two methods was in programming time (115 hours). At this point, programming was, of course, being accomplished by engineers who were "learning by doing" and it was expected that programming time would be cut substantially.

Work was also done on a bottom die block, *Fig.* 4. The work done on this block was finish machining only. Programming presented no particular difficulties since it covered strictly two-dimensional work, with the *Z* axis being held at constant value.

Work on the bottom die block proved the rigidity of the Kearney & Trecker machine and its capability for handling heavy work. The block was probably the largest piece ever put on one of these machines.

Template Work: In order to utilize the time between programming and machining of die blocks, and also to keep the machine in operation, several parts and templates were machined. These were of such design that they provided experience applicable to die sinking practices.

The templates cut were large male and female parabolic designs, *Fig.* 5, 127 inches acros the top of the curve and 40 inches in height, with the parabola defined by $y^2 = 94.54x$. The tolerance for abutment of the female within the male template should not exceed 0.005 inch. These templates were successfully machined and the tolerance observed during inspection was not greater than 0.003 inch at any point. Only a light draw filing was performed on the machined surface to obtain a smooth finish. Manufacture of the templates by hand would have required 80.25 hours; total time for numerically controlled production was only 49.75 hours including 15 hours for programming. It is unlikely that the templates could be made by hand to hold a tolerance of 0.005 inch.

Top Die Block: Following production of the templates, which demonstrated the inherent accuracy of the machine and control unit, work was accomplished on machining of a top die block, *Fig.* 6. Machining of the rectangular arms presented some unique programming problems, particularly blending the corners. A large number of passes were required to accomplish this amount of work.

Because of the high cost of a complete tape if all five arms were programmed, the tape called for machining of only one arm, with the other four arms to be machined after the block had been rotated into the correct position. The machining of only one arm at a time proved to be a disadvantage because of the time required to rotate and relocate the die block after the machining of each arm.

Due to urgent production deadlines, machining was completed on a conventional machine. However, sufficient data were accumulated to furnish a comparison. Some 115 hours would be required for the conventional method, including 51 hours to make a model. Over 179 hours were reqiured for numerical control, with 115 hours of programming included. These figures show a considerable time advantage for the conventional method. Reduction of programming time and accelerated feed rates in space, plus the determination of optimum cutting rates were, at this time, obviously the major factors to be worked on in future experiments.

Computer Routines: Work with a new computer subroutine, the COMPAC-02 illustrates some of the difficulties that can arise in numerical control.

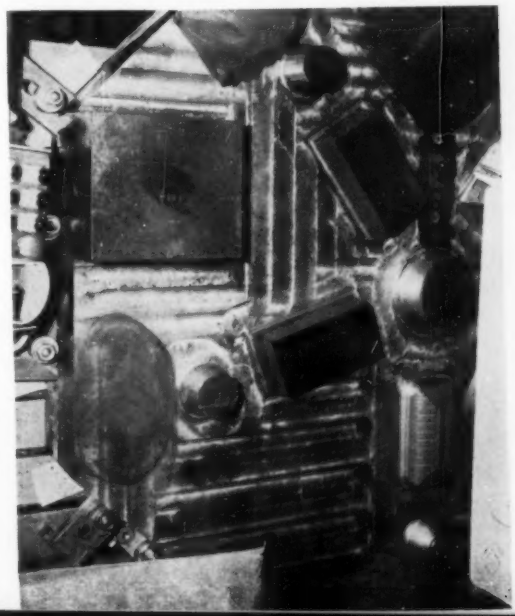


Fig. 6. Top die block. Developing a program for machining this block was a real challenge to the numerical control group.

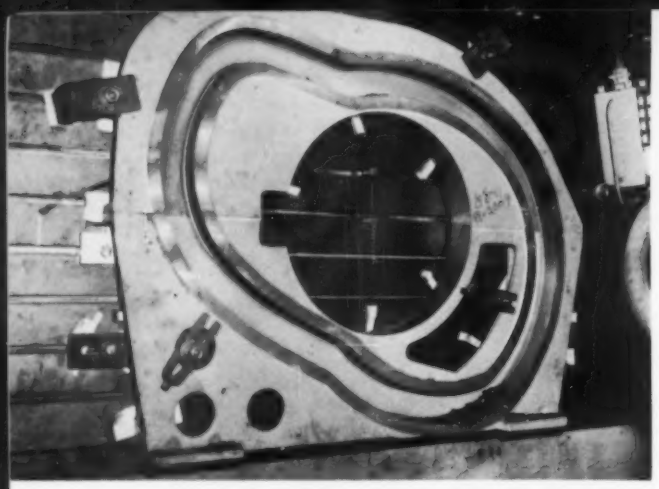


Fig. 7. Cam follower track—a production part—presents some of the same problems as a die.

This subroutine is used to prepare a table of coordinates on any curved section by using a computer instead of hand calculations.

The first work using the COMPAC-02 routine was machining of a cam follower track, *Fig.* 7. Two cutter paths were programmed: one for the outside wall and one for the inside wall, to provide climb milling on both surfaces. Results with the first tape that was produced were unsatisfactory. Investigation disclosed that there were no programming errors and that the difficulty was apparently attributable to a malfunctioning computer. A second tape was also unsatisfactory, due to a clerical error in reading one of the points indicated on the process sheets. A third tape also gave poor results.

Other work using the new subroutine gave excellent results. Twelve heat-sink templates were programmed and machined. On completion of machining, the curves did not match the pins on the checking fixture furnished. By placing the templates on master layout drawings, however, it was learned that the parts were machined correctly and that the checking fixture was in error. Production of these templates by conventional methods would have required 251 hours; production by numerical control, including programming, required a total of 109 hours.

Production Work: Commercial work accomplished during intervals when die sinking work was not being done on the machine, included machining of flanges on 10 cover plates, *Fig.* 8. The job involved machining the face of the flange and machining a step and an O-ring groove in the face of the flange. Programming required 1½ hours. For comparative purposes, two parts were machined on a Keller machine, using tracer control. They required 16 hours each for complete machining. The first piece produced under numerical control required five hours to complete because the machine was stopped at various points to check dimensional accuracy and to test-run the tape. Remaining pieces were machined in three hours each, including setup time. Total elapsed time for the 10 pieces was 32 hours—the same amount of time required to produce only two pieces by conventional methods. A 63-microinch (rms) finish was specified; the actual finish was 23 microinches.

During the same period, an order for 30 cams was also accepted. These cams were 30 x 24 inches and were cut from ½-inch stock, ground flat. A tolerance of ±0.0005 inch on the curvature was required. Templates produced were well within the required tolerance.

Maintenance: Trouble-shooting with the numerically controlled machine proved to be somewhat more complicated than with conventional machines because the control system, with its complex circuitry and hundreds of tubes, presents a real challenge to newly trained electronics technicians. Maintenance is simplified by the modular

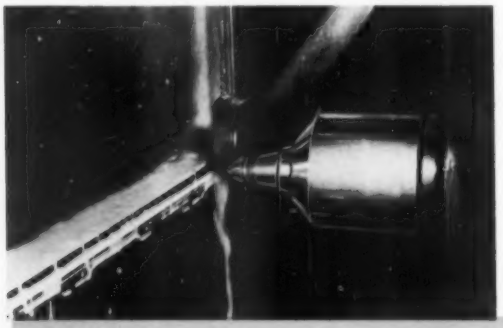


Fig. 8. (above) Machining of flange on a missile part.

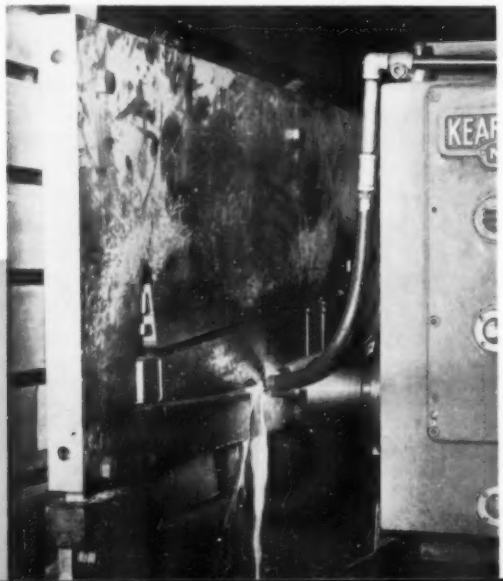


Fig. 9. (right) Test block for a production die. To check on programming, the die is being cut from a piece of two-inch steel stock prior to machining of actual die.

construction of the control unit and all components are readily accessible for service. Difficulties with the machine itself did not present so great a problem during the run-in period because maintenance personnel were, of course, generally familiar with machine operation and maintenance.

Maintenance of the control system was accomplished by two technicians who had thorough training by the control manufacturer. An additional aid to maintenance resulted from experiments intended to facilitate trouble shooting. In the experiment, failed tubes were deliberately inserted, one at a time, in the various positions of the tube package. The effects on the machine control unit—therefore on the machine motions—were listed. This list is a convenient guide when machine malfunctions attributable to tube failure are encountered.

With experience, it was possible to determine what electronic components and other spare parts failed most frequently. Such components are now stored in the plant, enabling repairs to be made quickly, without excessive machine downtime.

Programming: As the programming of different jobs progressed, the programming procedure evolved into a more or less standard pattern. This pattern is illustrated by the programming of a second production die block, *Fig.* 9.

After receiving management approval of the selection of this block, the numerical control group met and decided on the general outline of the work and procedures to be followed. The programming assignment was handled by a graduate engineer who is the regular programmer, and a die-shop foreman who is a trained die sinker. These men compliment each other in abilities and training. Both received instruction at the Bendix school.

At the inception of programming, the shop man describes the starting point cutter paths, feed rates and cutter diameters, based on his long experience. From this general outline the programmer separates the work into sections and the transposition of drawing data into numerical form is started.

As the necessary mathematical computations are performed for the predetermined cutter path, data is entered on the process sheets, *Fig.* 10. Simultaneously, the shop man makes a sketch of the cutter path on an outline of the die. This cutter path drawing, subsequently used by the machine operator, is called a "road map," *Fig.* 11.

Many of these road map sketches are required for each die block. They tell the operator what the machine should be doing and inform him when to change cutters and the like. For example, a number of machine stops are scheduled during programming. These stops are automatic. When the machine stops, the operator checks his road map to find out what to do at this point. Changing a cutter, reversing to a reference point and making a second pass are specific examples. The operator can stop the machine or override feed instructions.

After programming is completed, the entire job is reviewed and the calculations are checked by another programmer. Then the manuscript sheets are sent to the plant IBM department for preparation of IBM cards. A print-out of the cards is made and checked for accuracy. The cards, with the print-out and a set of process sheets is sent to the

BENDIX "COMPAC-I" PROCESS SHEET

DATE 25 MARCH 1959 — SHEET NO. 54 OF 105
PLANNER J.M. SARKISIAN — PART NO. WG-28221 — JOB NO. 56
L. WAGNER — TAPE NO. 56-E

POINT NOTATION	LINE NO.	SETUP POINT X IN.	Y IN.	Z IN.	CLEARANCE PLANE Z_0 IN.	TOLERANCE IN.	TYPE APPROX.

	LINE NO.	END POINT OF SECTION X IN.	Y IN.	Z IN.	INITIAL CLEARANCE IN.	CIRCLE RADIUS IN.	ARC LENGTH	CORNER	TYPE POINT	R 00	LINE NO.	FEED RATE IN./MIN.	TOOL DIAMETER IN.	R 40	LINE NO.	AUX FUNCTION	R 41	LINE NO.	FINAL CUT IN.	PAUSE ST.	PHASE NO.	DELAYS	R 01
	22	014.0820	002.8866	-001.4091		000.5033	1	0	2	00													
	23	014.0820	001.7812	-001.4091			0	0	2	00													
	24	018.2680	001.7812	-001.4091			0	0	2	00													
	25	021.4888	004.9520	-001.4091		-003.2208	1	0	2	00													
	26	021.4888	004.9520	-001.4091			0	0	-2	00													
	27	018.5553	008.1600	-001.4091		-003.2208	1	0	2	00													
	28	018.0969	008.6559	-001.4091		000.5033	1	0	2	00													
	29	017.3087	008.6559	-001.4091			0	0	2	00													
	30	016.8286	008.3036	-001.4091		000.5033	1	0	2	00													
	31	015.5622	008.3036	-001.4091			0	0	2	00													
	32	014.1102	006.1815	-001.4091			0	0	2	00													
	33	014.8929	005.6460	-001.4091			0	0	2	00													
	34	015.0000	006.0000	-001.4091			0	0	2	00													
	35	014.3929	006.0000	-001.4091			0	0	-2	00													
	36	014.3929	002.3049	-001.4091			0	0	2	00													
	37	015.5000	002.3049	-001.4091			0	0	0	00													
(38)																							
	40	016.2549	005.0325	-001.4091			0	0	-2	00													
	41	017.7144	003.5130	-001.4091		001.4595	2	0	2	00													
	42	017.7144	003.5130	-001.4091			0	0	-2	00													

Fig. 10. Process sheet prepared by programmer. This data is put on IBM cards. Cards are fed into computer which performs necessary calculations and prints tape.

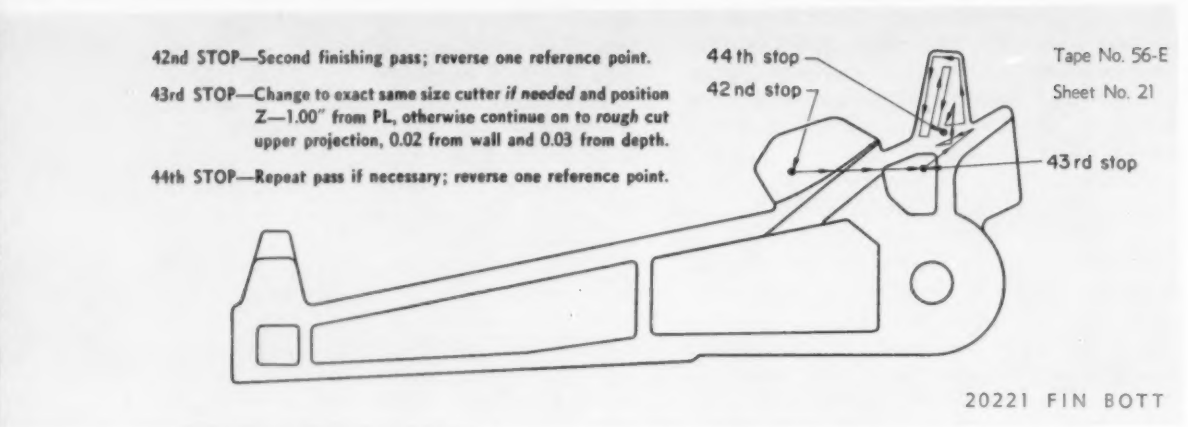

42nd STOP—Second finishing pass; reverse one reference point.
43rd STOP—Change to exact same size cutter *if needed* and position Z—1.00" from PL, otherwise continue on to *rough* cut upper projection, 0.02 from wall and 0.03 from depth.
44th STOP—Repeat pass if necessary; reverse one reference point.
44th stop
42nd stop
43rd stop
Tape No. 56-E
Sheet No. 21
20221 FIN BOTT

Fig. 11. Operator's road map lets him know what machine should be doing at any time, informs him when to change tools and perform other operator functions.

Bendix control tape center for tape preparation.

The IBM cards are fed directly into the computer to produce the machine control tape. The process sheets and print-outs are sent along with the cards so that if some routine that has been programmed is not compatible with computer functioning, it can be corrected immediately by telephone.

Programming of the die block shown in *Fig.* 9 created no special problems, since the programmer now had some 15 months of experience. The errors that showed up during production tests on a piece of two-inch steel stock were mostly of a clerical nature and were easily corrected. After debugging of control tapes, production of the final die block was completed without trouble.

Conclusions: Work at Wyman-Gordon has not yet progressed to the point where any final conclusions can be drawn as to the economical feasibility of numerically controlled die sinking. At present, programming of die blocks still takes a great deal of time. This is due, at least partially, to the inability of computer routines to develop simple programs for three axes. With the development of more versatile computer routines, the time required for programming will be substantially reduced. A breakthrough in this direction has already been made at the Massachusetts Institute of Technology.

Freedom of action for the numerical control group—they have been allowed to select their own parts and to develop their own programming procedures—has unquestionably made it possible to obtain maximum results with the numerically controlled machine. Members of the group also visited other companies doing three-dimensional milling under tape control, and this has resulted in a mutually helpful interchange of ideas and experience.

At the start of the program it was felt that machine operators would view numerical control unfavorably. However, machine operators have accepted this new technique enthusiastically and many more of them have requested training in this field than can be accommodated at present. On the basis of present experience, it can be said that the operators of numerically controlled machines must be even more intelligent, alert and resourceful than the operators of conventional die sinking machines. Thorough training is required.

Members of the numerical control group believe, on the basis of their present experience, that numerically controlled machining will be widely used in industry within the next few years. Shortened lead times, faster machining and improved quality have been obtained when the Kearney & Trecker machine was used for the production of cams, templates and parts.

On the basis of the work done to date, members of the group are not entirely convinced that numerically controlled machining is the best means of shortening die sinking lead time. They presently tend toward the view that a combination of machines—a conventional machine to perform free-hand roughing or hogging operations and a numerically controlled machine for the second pass and finish operations—might be the best solution.

A vertical-spindle manually controlled machine, with the operator working to a simple layout, could probably produce a die block faster than a numerically controlled machine when the time required for programming and tape preparation is considered. However, on finishing operations the speed and accuracy obtained under numerical control cannot be approached by conventional methods. Numerically controlled machines are, of course, capable of performing roughing operations, but an over-all time comparison at this writing favors the standard machine. This opinion may change when programming techniques are improved.

tool geometry and machine settings for

TURNING TITANIUM

TURNING TITANIUM is probably the least difficult of all titanium machining operations. Cutting tools, however, must be selected and ground carefully to insure best performance and most economical production. The high temperature generated in cutting titanium contributes to the early failure of cutting tools. Through proper machine setting and coolants, surface finishes of 20 to 30 microinches, rms, are obtainable with ± 0.001 inch tolerances.

Recommended tool geometry and machine settings for scale removal, rough and interrupted cutting, semifinish and finish turning of commercially pure and alloy grades are presented in the accompanying tables.

Extracted from Titanium Engineering Bulletin No. 7, *Titanium Machining Techniques*, published by Titanium Metals Corp. of America, New York, N. Y.

Scale or Skin Removal

Tool Materials

Type of Cut	1st Choice	2nd Choice	3rd Choice
Continuous	C-1 or C-2 carbide	Cast alloys	T-5 HSS
Interrupted	T-5 HSS	Cast alloys	C-1 or C-5 carbide

Tool Geometry

Angle	Tool Material: Carbide	Cast Alloy	HSS
Back rake (deg)	+5 to −5	0 to +5	0 to +5
Side rake (deg)	0 to −6*	0 to +5	0 to +5
SCEA† (deg)	+5 to +25	+5 to +6	+5 to +6
ECEA‡ (deg)	+6 to +10	+5 to +6	+5 to +6
End relief (deg)	+5 to +10	+5 to +7	+5 to +7
Side relief (deg)	+5 to +10	+5 to +7	+5 to +7
Nose radius, in.	0.050–0.125**	0.02 to 0.03	0.02 to 0.03

†Side cutting edge angle.

‡End cutting edge angle.

*Negative rake angles best, but require rigid equipment.

**Reduce nose radius if excessive chatter occurs.

Machine Settings

Titanium Grade	Speed (fpm)	Feed (ipr)	Depth of Cut (inch)
Commercially Pure			
Carbide tools	80-100	0.005-0.008	Get under scale*
Cast alloy tools	40-50	0.003-0.006	
HSS tools	20-35	0.002-0.003	
Annealed Alloys			
Carbide tools	50-70	0.005-0.008	
Cast alloy tools	25-35	0.003-0.006	
HSS tools	15-25	0.002-0.003	
Heat-Treated Alloys			
Carbide tools	25-45	0.0025-0.004	
Cast alloy tools	15-25	0.003-0.006	
HSS tools	5-15	0.002-0.003	

*Tool should cut at least 0.020 inch deeper than tool radius.

Rough Turning and Interrupted Cutting

Tool Materials

Type of Cut	1st Choice	2nd Choice	3rd Choice
Interrupted	T-5 HSS	Cast alloy	C-1 or C-5 carbide
Form	T-5 HSS	Cast alloy	C-1 or C-5 carbide
Plunge	T-5 HSS	Cast alloy	C-1 or C-5 carbide
Severe plunge	Cast alloy	T-5 HSS	C-1 or C-5 carbide
Dead center	Cast alloy	T-5 HSS	C-1 or C-5 carbide
Grooving	Cast alloy	T-5 HSS	C-1 or C-5 carbide
Continuous rough turning	C-1 or C-2 carbide	Cast alloy	T-5 HSS

Semifinish Turning

Tool Materials

Type of Cut	1st Choice	2nd Choice	3rd Choice
Continuous	C-2 carbide	T-5 HSS	Cast alloy
Plunge cuts, grooving	T-5 HSS	Cast alloy	C-2 carbide

Finish Turning

Tool Materials

Type of Cut	1st Choice	2nd Choice	3rd Choice
Continuous turning	C-3 or C-4 carbide	T-5 HSS	Cast alloy
Grooving	T-5 HSS	Cast alloy	C-1 or C-2 carbide

Tool Geometry

Angle	Tool Material: Carbide	Cast Alloy	HSS
Back rake (deg)	+5 to −5	0 to +5	0 to +5
Side rake (deg)	0 to −6	0 to +5	0 to +15
SCEA† (deg)	+5 to +25	+6 to +15	+6 to +15
ECEA‡ (deg)	+6 to +10	+5 to +6	+5 to +6
End relief (deg)	+5 to +10	+5 to +7	+5 to +7
Side relief (deg)	+5 to +10	+5 to +7	+5 to +7
Nose radius (in.)	0.03 to 0.045	0.02 to 0.03	0.02 to 0.03

†Side cutting edge angle.
‡End cutting edge angle.

Machine Settings

Titanium Grade	Speed (fpm)	Feed (ipr)	Depth of Cut (inch)
Commercially Pure			
Carbide tools	100-240	0.008-0.015	Greater than 0.100
Cast alloy tools	80-90	0.005-0.010	
HSS tools	25-124*	0.004-0.050	
Annealed Alloys			
Carbide tools	75-120	0.008-0.015	
Cast alloy tools	40-50	0.005-0.010	
HSS tools	25-60	0.004-0.015	
Heat-Treated Alloys			
Carbide tools	50-95	0.008-0.015	
Cast alloy tools	25-40	0.005-0.010	
HSS tools	10-50	0.004-0.015	

*As feed rates increase, speed should decrease to maintain reasonable tool life.

Tool Geometry

Angle	Tool Material: Carbide	Cast Alloy	HSS
Back rake (deg)	+5 to −5	0 to +5	0 to +5
Side rake (deg)	+6 to −6	0 to +5	0 to +15
SCEA† (deg)	+5 to +20	+6 to +15	+6 to +15
ECEA‡ (deg)	+6 to +10	+5 to +6	+5 to +6
End relief (deg)	+5 to +10	+5 to +7	+5 to +7
Side relief (deg)	+5 to +10	+5 to +7	+5 to +7
Nose radius (in.)	0.03 to 0.045	0.02 to 0.03	0.02 to 0.03

†Side cutting edge angle.
‡End cutting edge angle.

Machine Settings

Titanium Grade	Speed (fpm)	Feed (ipr)	Depth of Cut (inch)
Commercially Pure			
Carbide tools	220-320	0.006-0.015	0.030-0.100
Cast alloy tools	100-200	0.004-0.10	0.030-0.100
HSS tools	60-160	0.003-0.008	0.030-0.100
Annealed Alloys			
Carbide tools	100-160	0.006-0.015	0.030-0.100
Cast alloy tools	50-80	0.004-0.010	0.030-0.100
HSS tools	30-60	0.003-0.008	0.030-0.100
Heat-Treated Alloys			
Carbide tools	75-155	0.006-0.015	0.030-0.100
Cast alloy tools	35-70	0.004-0.010	0.030-0.100
HSS tools	15-50	0.003-0.008	0.030-0.100

Tool Geometry

Angle	Tool Material: Carbide	Cast Alloy	HSS
Bake rake (deg)	0 to +5	0 to +5	0 to +5
Side rake (deg)	0 to +15	0 to +5	0 to +5
SCEA† (deg)	0 to +20	+5 to +6	+5 to +6
ECEA‡ (deg)	+6 to +10	+5 to +6	+5 to +6
End relief (deg)	+5 to +10	+5 to +7	+5 to +7
Side relief (deg)	+5 to +10	+5 to +7	+5 to +7
Nose radius (in.)	0.030 to 0.045	0.020 to 0.030	0.020 to 0.030

†Side cutting edge angle.
‡End cutting edge angle.

Machine Settings

Titanium Grade	Speed (fpm)	Feed (ipr)	Depth of Cut (inch)
Commercially Pure			
Carbide tools	200-350	0.003-0.012	0.003-0.030
Cast alloy tools	100-200	0.002-0.005	0.003-0.030
HSS	76-160	0.002-0.005	0.003-0.030
Annealed Alloys			
Carbide tools	100-300	0.003-0.012	0.003-0.030
Cast alloy tools	65-80	0.002-0.005	0.003-0.030
HSS	45-60	0.002-0.005	0.003-0.030
Heat-Treated Alloys			
Carbide tools	75-275	0.003-0.012	0.003-0.030
Cast alloy tools	50-70	0.002-0.005	0.003-0.030
HSS	30-50	0.002-0.005	0.003-0.030

REFERENCE SHEET

tool geometry and machine settings for

MILLING TITANIUM

MILLING TITANIUM is more difficult than turning because of the intemittent cutting action. Chipping is a problem and is alleviated to a large degree by climb milling instead of conventional milling. Light feeds also reduce the chip in contact with the cutter, further lowering the possibility of chipping.

High-speed steel tools have generally proved to be most satisfactory as a tool material where production rates are not high or when equipment lacks the necessary rigidity required for carbide tools. Long production runs make the use of carbide tools feasible. Some fabricators regard cast-alloy tools as a workable compromise. Cast alloys give about 25 percent increase in cutting rates over high-speed steels, and provide more resistance to chipping action that causes failure in carbide tools. Guides for selection of tool materials, geometry and machine settings are given in the accompanying tables.

Extracted from Titanium Engineering Bulletin No. 7, *Titanium Machining Techniques*, published by Titanium Metals Corp. of America, New York, N. Y.

Tool Materials

Operation	1st Choice	2nd Choice	3rd Choice
Low production	T-5 HSS	Cast alloy	C-1 or C-2 carbide
Form cutters	T-5 HSS	Cast alloy	C-1 or C-2 carbide
Face milling	C-1 or C-2 carbide or cast alloy HSS		
Slab milling	C-1 or C-2 carbide or cast alloy HSS		

Tool Geometry

Angle	Tool Material: Carbide	Cast Alloy	HSS
Radial rake (deg)	0 to −10	0	0
Axial rake (deg)	0 to −10	0	0
FCEA† (deg)	6	6	6
PCEA‡ (deg)	60	30	30
Face relief* (deg)	12	12	12
Peripheral relief* (deg)	12	12	12
Chamfer (deg)	0 to 45	0 to 45	0 to 45
Nose radius (in.)	0.040 to 0.125	0.040 to 0.125	0.040 to 0.125

†Face cutting edge angle or end cutting edge angle.
‡Peripheral cutting edge angle or corner angle.
*Use smaller relief angles if excessive chipping occurs.

Machine Settings

Titanium Grade	Speed (fpm)	Feed (ipt)*
Commercially Pure		
Carbide tools	160-190	0.004-0.008
Cast alloy tools	120-140	0.004-0.008
HSS tools	80-110	0.003-0.006
Annealed Alloys		
Carbide tools	80-120	0.004-0.008
Cast alloy tools	60-100	0.004-0.008
HSS tools	40-70	0.003-0.006
Heat-Treated Alloys		
Carbide tools	55-95	0.004-0.008
Cast alloy tools	45-90	0.004-0.008
HSS tools	25-60	0.003-0.006

*Inch per tooth.

NOTE: Maximum depth of cut for face milling, 0.050 inch; for slab milling, 0.100 inch. For scale or forging skin removal, depth of cut must be below skin by 0.020 inch greater than nose radius.

ASTE news

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movement underway

To Add

WHAT'S in a name?

Lots.

On that, at least, both proponents and opponents of a current movement to modify the Society's name are in agreement. Under the proposal, which at this writing is in the petition-circulating stage, the words "and Manufacturing" would be added to the Society title, making it the American Society of Tool and Manufacturing Engineers.

Some 12 years of study and debate—along with about as many pounds of papers pertinent to the issue, which have accumulated at Headquarters—add weighty testimony to the fact that there is indeed lots in a name. On file at 10700 Puritan are many fervent letters defending the American Society of Tool Engineers and all that the name connotes—and many other fervent letters advocating changes or additions to the name.

Neutrality has been rare. One member, approached during one of the several thorough surveys and member-opinion polls that have been conducted over the years, seemed to put himself on record as siding with the Shakespeare character who said, "That which we call a rose, by any other name would smell as sweet." This tool engineer paraphrased the poet thusly: "There's nothing in a name except what we make it. Our membership would still be the same people."

What the member overlooked, however, is that a name sometimes helps make the person or thing it represents.

That reality is one reason for the present well-supported campaign to add to the Society's name. The ASTE's Long-Range Planning Committee—consisting of the board of directors, the national officers, the two immediate past presidents and the chairman of the National Constitution and Bylaws Committee—decided unanimously at its last meeting that the Society's name should be expanded.

Recognizes Expanding Scope of Society

"We are certainly not ashamed of our title, tool engineer, but because it does not generally convey to industry, to educators, and even to our members the broad function and the importance of tool engineering, it was unanimously decided to add 'manufacturing' to our title," declared Vice President Dale Long.

More pointedly, President Wayne Ewing said: "If it is correct to say that there is strength in numbers, then certainly we should make a concerted effort to encompass that segment of manufacturing engineers before some other society beats us to it . . . I choose to take the positive approach."

An indication of the broad scope of tool engineering and the broad interests of ASTE members is the editorial diet given them by their national magazine, THE TOOL ENGINEER. Periodic and thorough research into readership preferences determines this diet. Although "tool engineer" in its narrowest meaning is associated only with tooling, that field accounts for less than one-third of the engineering articles in the magazine. Many articles cover processes, materials, management, quality control, and other categories of legitimate concern to practicing tool engineers. One hundred percent of the content falls within the broader confines of "tool and manufacturing engineers."

The Long-Range Planning Committee feels that the proposed titular addition will retain the advantages and traditions associated with ASTE and will, at the same time, recognize the expanding scope and needs of the Society. In a memorandum to directors urging execution of the petitions, Ewing said: "It is apparent the expanded name keeps pace with the times and recognizes the foundation upon which the Society was organized, namely, the recognition of progress."

'Manufacturing' To Society's Name

Many committees have studied the problem in the past, painstakingly analyzing and finally rejecting many names other than the one now being advocated. The recent findings, culled from 1601 member replies to questionnaires, disclosed that:

- **More than half felt that "manufacturing engineer" or "tool and manufacturing engineer" more adequately describes the duties or functions of Society members.**
- **More than half said the name "tool engineer" is often restricted to the application of cutting tools.**
- **More than half believed "manufacturing engineer" or "tool and manufacturing engineer" would be better understood by educational institutions and other societies.**
- **Only a third felt the present name is adequate.**

Something Old, Something New

Efforts in recent years to change the Society's title have been unsuccessful, in large measure, because the proposals have involved dropping the time-honored and esteemed words, tool engineer. Such proposals have been anathema to many of the Society's proud pioneers. The Society's leaders now feel that ASTME—containing both something old and something new—is a realistic and mandatory answer to the problem.

The following steps are necessary before the American Society of Tool and Manufacturing Engineers could become official:

- **Signatures of 400 eligible voting members checked and validated at Headquarters.**
- **Approval, by ballot, of a majority of all chapter C&B committees on whether the proposal should be put to a Society-wide vote.**
- **If chapter C&B committees favor a referendum, then the national C&B committee must prepare a ballot to be sent to each Society member.**
- **Final approval or disapproval would be decided by a majority of the votes cast by the membership.**

Proponents of the addition to the name disclaim any intention to "open the gates" for new members. One officer asserted, "We do not intend to change our membership requirements one iota. The fact of the matter is, we are tending to be more fussy about meeting our membership standards than we have been in the past."

The ultimate decision is the responsibility of rank and file members. You name it!

At Golden Gate chapter's 20th anniversary meeting, Past Chairmen Dean Douland, Ed Raves and Carl Horack quiz President Wayne Ewing about proposal to add "Manufacturing" to Society's name.

ASTE Backs of

by M. L. Stone
news editor

CONSIDERED A SURE THING as the ASTE's national directors went into a budgetary huddle at St. Louis this past month was a $2000 grant to a fast-growing juvenile gang called the JETS.

Although JETS members are chronologically juvenile, they're not chronically so, like the more publicized gangs. In fact, this "gang" is as adult a bunch of teen-agers as you'll find anywhere, and there's not a delinquent among the 15,000 of them.

Their symbol is a slip-stick rather than a switch blade.

They are heavily armed, however, with enthusiasm and ambition. And thanks to an efficient headquarters and the benefaction of individuals and industries and societies such as ASTE, they're fed a steady supply of scientific and technological ammunition.

Members of the JETS—short for Junior Engineering Technical Society—are banded together in 473 clubs representing that many secondary schools in 39 states and eight foreign countries. There are seven clubs in Puerto Rico, for instance; one in Thailand, even one in the Ryukyu Islands; no less than 173 in Michigan.

Recognition by Adult Colleagues

Amazingly, all this growth has taken place since 1950. That was when two engineering professors at Michigan State University—with a pre-Sputnick awareness that scientific and engineering orientation was a critical need at the high school level—organized the first two JETS clubs at neighboring schools around East Lansing.

Since then, the movement has reached a maturity beyond its years and promises to be a real factor in the free world's struggle for space and peace.

No better evidence of JETS maturity can be found than the recognition recently coming from their adult colleagues. Almost simultaneous with the ASTE's endorsement was a $16,680 grant from the National Science Foundation.

Among JETS' distinguished board of directors, guiding the fortunes of the nonprofit adventure in careering engineering, are such people as Maj. Gen. John B. Medaris of the Army Ordnance Missile Command; Lt. Gen. Bernard A. Schriever, head of the Air Research and Development Command; Kenneth Ellington, vice-president, Republic Aviation Corp.; L. R. Baker, director, Chrysler Institute of Engineering; Dr. John A. Hannah, MSU president, and Dr. John D. Ryder, MSU dean of engineering; and other leaders of equal stature in industry, education and government. Richard T. Fallon is executive director of JETS, which is still headquartered at, but no longer administered by, the university.

If any further evidence of JETS maturity is needed, then by their deeds you can know them. The boys—and an ever-growing number of girls—after first demonstrating interest and aptitude, explore the different branches of engineering to discover which interests them most. Their club work is entirely voluntary, entirely extracurricular. They learn what engineers do at work, by over-the-shoulder observation on "Big Brother" days spent in-plant, and by actually constructing projects in the field of their choice. They've built digital computers, turbines, rockets, radios, Geiger counters, electric furnaces, power plants, and many other complex accoutrements of the present and possibly the future. The only limit on JETS activities is the sky, and the sky's unlimited these days.

The potential for a good sound grounding in engineering discipline couldn't long be ignored by ASTE; the Society's board of directors formally endorsed JETS at the Milwaukee Annual Meeting last spring.

National Encourages Chapters to Help

Both unselfish and admittedly selfish motives lie behind the big brother role which the Society has officially assumed. Other than its desire to give merited support to a worthy organization, the ASTE recognizes the JETS as a spawning ground for tool engineers of tomorrow—and for future members of ASTE.

Grown-Up 'Gang' Juveniles Called JETS

National is encouraging chapters to help establish and promote the junior engineer clubs. It is imperative that ASTE chapters bear in mind two things, though, in their work with the students:

- JETS clubs are autonomous; support from ASTE should be on a no-strings-attached basis.
- Tool engineering should be kept in perspective as only one of the phases of engineering and physical science encompassed by JETS' interests.

Here are some ways ASTE could help: suggest speakers and plant tours; offer expert counsel and guidance to members on their individual projects; provide vocational information for regular mailing to club members; prepare written outlines of projects that would be of interest and value to the students; offer the services of a qualified "engineering consultant" (which each JETS club has) when new clubs are being formed; contribute articles, when appropriate, for the excellent biweekly newsletters, JETS-O-GRAMs, which go out to club members; sponsor competitions and offer prizes for the best projects, perhaps helping to stage engineering exhibits on a local or regional basis.

The most important contribution an ASTE chapter can make to JETS, however, is to *help win the support of local industries.*

Lancaster Chapter Lends a Hand

Many chapters have already become beneficially involved in JETS programs. Perhaps typical is the experience of Chapter 89, Greater Lancaster (Pa.).

According to John M. Denuel, educational chairman of the chapter and the motive force behind ASTE's sponsorship of JETS in Lancaster, the seeds of the chapter's interest were planted at a chapter-sponsored seminar in June, 1956. The seminar's subject was "Where Will We Acquire Our Future Engineers and Technicians?" As a result of the session, in which clutch groups representing education and 13 leading industries roundly debated what to do about the area's acute shortage of technological talent, Chapter 89 decided to contact JETS.

Prof. Harold P. Skamser of MSU, who, along with Dean Emeritus Loren Miller, had been one of the original founders of JETS, came to Lancaster that fall to tell his urgent story to ASTE members.

Untiring follow-up work by Denuel and other interested ASTE members finally got results. One of the two city high schools, Lancaster Catholic, agreed to cooperate. It assigned one of its most dedicated teachers to be faculty adviser to the new club—Sister Marie Olivette, O.S.F., expert in math, physics, radio, electricity, and youth.

A registered professional engineer named Lee Homsher, who works at Armstrong Cork, the city's biggest plant, volunteered his services as consulting engineer to JETS. He got a kit from headquarters in East Lansing, and "followed the book." He was thoroughly converted and so was his son; Michael Homsher is "copilot" (president) of the club.

Twenty-eight students originally applied for membership. Through interviews, counseling and testing, the number was cut almost in half. The result, said Sister Marie, was a high-level group of high-interest students. Alpha Mu's, as they called themselves, got their charter as the 290th JETS chapter.

This year, 19 members are already well into the

Copilot Michael Homsher of the Lancaster (Pa.) Catholic High JETS produces a four-inch "bolt of lightning" on a JETS-built generator during meeting with Greater Lancaster ASTE chapter's executive committee. Watching are Chapter Chairman Dale Sensenig, Education Chairman John Denuel, and JETS Communications Officer William Byrd.

JETS' new "academic unit" program that systematically takes up the study of the whole range of engineering and applied sciences. Sixteen such biweekly study units comprise the JETS academic year. In many instances the title of the unit is similar to that of a course taught in an engineering college—statistics, dynamics, machine elements, fluid mechanics, etc.

Clubs Strictly Self-Governing

"The students themselves govern the club. I don't," said Sister Marie. "They drew up their own constitution and bylaws; they plan their own programs; they designed their own letterheads for the stationery they use to line up their own speakers.

First-place entry in the metallurgical classification at the JETS Engineering Exposition was this foundry furnace, built by Daniel S. Kasprzk, Hutchinson Central Technical School, Buffalo, N. Y. The school held a celebration for Dan when he got home from the East Lansing fair.

"JETS is essentially exploratory. It helps the students 'find' themselves." The sister added with a twinkle, "And at least one of my last year's seniors —the communications officer—found he didn't belong in JETS at all. He's now in a seminary!"

National's endorsement has revived Greater Lancaster's interest in JETS. Chairman Dale Sensenig has "drafted" every chapter member to committee duty, which will make about 10 men on each committee. A strong education subcommittee will attempt to establish JETS clubs this year at the public high school in Lancaster and at other suburban and county schools. They hope to start an interschool competition among JETS, offering prizes for project winners. THE TOOL ENGINEER already goes to the Catholic High club.

"If we'd had national's backing, we wouldn't have had to call on the area Technical Societies Council for help last year," Denuel said. "We're taking the ball back again this year.'

Homsher recommends speakers but lets the club members get them. He is careful not to interfere with school affairs, but would like to see his club take in freshmen and sophomores as well as the last two grades. This is permitted in many JETS chapters. "The earlier you get them started in the right direction, the further they'll go in the right direction," he said.

65 Pct. Pursue Engineering in College

Substantiating this philosophy are the latest national figures released by JETS headquarters. Of JETS graduates last spring, 88 percent have gone on to college, 65 percent of them into engineering.

Of concern in the national picture, however, are other figures revealing that total college freshman engineering enrollment in the country has dropped off 11 percent, against a 7.2 percent increase in over-all college entrances. A study of this disturbing phenomenon by college deans and the Engineers Joint Council blamed part of the engineering drop on the recent pressures to emphasize basic science rather than applied science and engineering.

In an effort to help restore equilibrium to the situation, Director Fallon declared, "JETS is getting back on the engineering bandwagon. While emphatically not intending to short-change Science with a capital S, JETS must increasingly try to channel its youthful talent toward fields of direct application."

Definitely slanted toward applied engineering are the annual JETS Engineering Expositions held at MSU. The junior engineers wag their pet projects in from all over the country, compete for prizes and scholarships, and have the time of their lives.

Their enthusiasm, in fact, is a match for ASTE's.

Consider the case of the two boys wearing JETS lapel pins who bought bus tickets from Springfield, Mass., to East Lansing, Mich., and checked their "baggage." Their baggage, bound for the fair, included seven man-sized cartons containing various devices which they had constructed for JETS projects.

Unfortunately, the cartons were honestly labeled "Scientific Equipment"—and this caused trouble at bus-change points on the 1400-mile round trip. Porters refused to touch the stuff, so the boys—Alan Chaffee and Thomas Burnett—transferred the mountain of baggage themselves.

Of such stuff engineers are made.

Dispatch

from St. Louis

"PROPHET WITHOUT A VEIL" URGES OVERHAUL OF TECHNOLOGY . . .

A drastic overhaul of American technology—leading to dramatic cost cuts—is mandatory if we are going to remain in an economically competitive position five years from now. This warning came from Dr. Ross M. Trump, dean of the business and public administration school of Washington University, and it was leveled squarely at 325 ASTE members, guests, educators and industrialists at the St. Louis Day dinner of the Society's Semiannual Meeting in St. Louis' Chase Hotel Oct. 7.

"Unless you people with the technological brainpower and will power can meet and beat the challenge of world competition, there's a pretty good chance you'll see the boom lowered on this boom of ours in the next few years," Dr. Trump said. The self-styled "prophet without a veil"—speaking an hour after the ASTE crowd had enjoyed a rooftop view of St. Louis' 77th annual Veiled Prophet parade—declared that politically the United States can no longer erect tariff barriers but must compete in world markets on a price basis.

"Already our costs are so badly out of line that competition is almost impossible," he said. For the first peace-time year in half a century our exports are less than our imports. More money is going out than coming in; the amount we shall pay out this year is over $4 billion. Even countries like Britain—traditionally one of our best customers—is this year selling us $100 million more than she is buying from us. The loss of this much gold, plus our tremendous national debt and continued inflation, has made a number of European countries uncertain of the dollar's stability. The dollar, in short, is shaky. . . ."

In the face of these challenges is a widespread complacency, engendered by present prosperity and high personal income. This complacency, Trump asserted, is alarmingly evident in the status quo of much of industry

and the obsolescence of much of industry's tools and plants. "Complacency even extends to education," he said, deploring a nationwide decrease of 11 percent in college engineering enrollments.

The ASTE's role is clear-cut, Trump concluded. It is to take the lead in working to improve our dangerous world market imbalance.

PRESIDENT EWING URGES WARTIME SENSE OF URGENCY . . .

Preceding Dr. Trump at the rostrum, President Wayne Ewing called upon ASTE's 40,000 members to develop a wartime sense of urgency. "We must tighten our collective belts, outproduce our foreign competitors. We are being pressed, and pressed hard. There's a little time left—let's make the most of it," Ewing said.

In an interim report on the move to add to the Society's name (detailed elsewhere in this issue), Ewing said that the ASTE's leaders had received a "gratifying, definite response" to petitions. Adding "Manufacturing" to the ASTE's title—making it ASTME—would be like "not losing a son but gaining a daughter," he said.

ENCONOMY-MINDED DIRECTORS APPROVE FISCAL 1960 BUDGET . . .

Adding here, subtracting there, erasing occasionally, the Board of Directors—meeting Oct. 8 at St. Louis—approved a $2 million-plus budget for fiscal 1960. Realism and downright caution, prompted by a $350,000 deficit in the year just ended, guided their deliberations.

TURNOVER RATIO CALLED ASTE'S TOP-PRIORITY PROBLEM . . .

"For every six we sign up, we lose five."

This analysis of membership turnover during the past year by National Membership Chairman A. E. ("Speed") Unruh received the undivided attention of ASTE's directors and officers. Vice President Dale Long labeled delinquency the Society's No. 1 problem. Budgets for many projects were approved because they were keyed not merely to getting the member, but to holding him.

OTHER ACTIONS OF THE BOARD:

Unanimously elected to the 1961 directors' nominating committee: G. Ben Berlien, Carl Darger, Truman Coy, Frank Ritchie and Philip R. Marsilius . . . The annual addition to the Research Fund Committee: William E. Rutz, executive vice president of Giddings & Lewis, former chapter chairman of Fond du Lac, Wisc. Elected as a replacement on the research committee: Past ASTE President Howard McMillen. On nomination of Past President George Goodwin, McMillen was also chosen to serve as committee chairman in place of James R. Weaver, hard-working chairman for the past two years . . . The charter of New Orleans Chapter 60 was recalled.

ATTENDANCE FIGURES GOOD, SOMETIMES EXCEPTIONAL . . .

Turnouts for the "real meat" of the St. Louis meeting, the technical sessions and the plant tours, were exceptional for a semiannual gathering. Figures like 55, 49 and 47 were posted for the dozen technical sessions. The three plant tours to Owens-Illinois, Emerson Electric and Carter Carburetor filled the buses; in the case of Emerson, some requests for tickets had to be refused. Monte Carlo night lured 286; the Semiannual Dinner-Dance registered a 400-ticket sellout.

After St. Louis . . . Comes Detroit

Les Bellamy (center), chairman, gives the go-ahead to a few members of his Detroit Host Committee and their proposed daily schedule of plant tours and ladies' activities for the Annual Meeting and Tool Show to be held April 21-28, 1960. The chairman's acceptance of their plans for the convention obviously pleases Wayne Kay (seated), division "A" chairman of plant tours, ladies' activities and transportation; Lorraine Wrobel, ladies' activities chairman; and Monte Cox (standing right), transportation chairman. Looking on at left with the cool eye of a typical budget director is Ben Wallis, Detroit chapter chairman and overseer of the Host Committee's finances. This confab took place at the joint meeting of the Host Committee and the National Program Committee in Detroit on Sept. 18.

Industry Bids for USU Grads

TOOL ENGINEERING GRADUATES of Utah State University are finding a ready welcome in industrial circles. The class of '59 boasts 17 members now working in industry over the nation. The average starting salary for these graduates was $523 a month, says Frederick Praetor, head of the tool engineering department at USU and a consultant member of ASTE's National Education Committee.

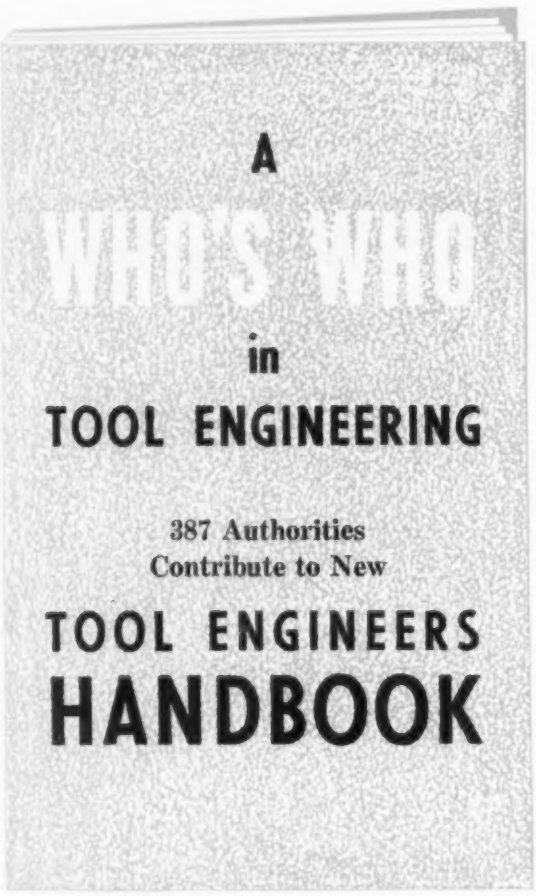
Further evidence that industry's door is open to USU graduates has most recently come from the Oldsmobile Div. of GM. They requested Prof. Praetor to provide them with a resumé of each of his graduating tool engineers.

The 17 graduates and their present employers are:

Ralph Anderson, Sperry Engineering Lab, Salt Lake City, Utah; Udell Albrechtsen, Naval Ordnance Lab, Corona, Calif.; Loyall Andersen and William Eik, Hewlett-Packard Co., Palo Alto, Calif.; Mark Barnard, Carl Mayers and Warner Stuart, Boeing Airplane Co., Seattle, Wash.; James Fowers, Naval Ordnance Lab, Point Mugu, Calif; Lyman Marler, Delco Electric in Indiana; Darrell Palmer, Marquardt Aircraft Co., Ogden, Utah; Richard Smith and Harry Taylor, Western Electric Co., Omaha, Neb.; McKinley Thomas, Shell Oil Co. of Canada; and Robert Wallentine, University of California Radiation Lab, Berkeley, Calif.

Utah State is the only college or university in the United States to offer a four-year course which grants a bachelor of science degree in tool engineering. This curriculum was initiated in 1951.

On campus, USU's student chapter flourishes with a membership of 45 students, quite an increase from their original membership of 19. Chartered in 1954, this was the second ASTE student chapter to be formed.



THE SECOND EDITION of the *Tool Engineers Handbook* is out. Its official debut took place at a press party in St. Louis at the Semiannual Meeting, when the publisher's representative presented it to ASTE President Wayne Ewing.

A week or two before that, a crate of the new handbooks came to Frank Wilson's office. The Headquarters staff looked them over, and nodded approvingly. Editor Wilson's grateful smile seemed to say, "I told you so."

Months ago, when the handbook was still in the shuttling stage, when manuscripts were passing back and forth among the contributors, the reviewers, the editor and the publishing house, Wilson was already calling it "monumental."

The finished job seems to be just that. Full credit, of course, should go to the volume's 387 contributors, who represent a veritable "Who's Who" in tool engineering.

The second edition is not a rehash. New and vital data, which up to this time had not been brought together in one volume, make the book more than a restatement of the first edition. "Expanded and improved," is what Wilson calls it. It covers every activity in which the tool engineer makes or influences a decision; it offers the reader the whole picture of tool engineering.

This whole picture includes background on the changes taking place because of the steady improvements in all standard machines, tools, materials, and methods. New ways to cut and form hard-to-machine materials are explained. High speeds, closer and more uniform tolerances, new standards, numerical control, are given the full treatment.

Practical Ways of Planning Processes

Feeling it is not enough to inform readers of how to perform these mechanical processes, the authors have included in the handbook practical ways of planning, operating and setting them up in plants and shops. Some of these are: new methods of controlling the economies required to meet the higher costs of manufacturing, predesign and postproduction value analysis, modern methods for better assurance of quality, advantages of learning curves for long-range determination of direct labor costs, and improved inventory practices.

Besides the tool engineering data the book contains a wealth of information needed by executives, designers and those who sell to and service the manufacturing industries.

The job of rounding up the many authors, reviewers and various other experts who participated in building the handbook fell upon the shoulders of a corps of 26 industrial revision groups. These groups were headed by appointees of the National Technical Publications Committee, overseers of the whole handbook project. The chairmen were:

George C. Adams, president, Webster-Adams Engrg. Co., Gardena, Calif.; Wallace F. Ardussi, president, Variety Stamping Corp., Cleveland; C. W. Besserer, senior technical staff, Space Technology Laboratories, Los Angeles; John S. Brozek, superintendent of tooling and maintenance, Sargent & Co., New Haven, Conn.; Frank W. Curtis, consulting engineer, Sarasota, Fla.; Clifford E. Evanson, president, T.A.B. Engrs., Inc., Chicago; Robert W. Ford, sales manager, Machine Tool Div., Ex-Cell-O Corp., Detroit; William H. Gourlie, standards engineer, The Sheffield Corp., West Hartford, Conn.; Robert S. Green, executive director, Engrg. Experiment Station, Ohio State Univ.; Richard D. Gross, chief industrial engineer, Baldwin-Lima-Hamilton Corp., Eddystone, Pa.; Oscar E. Koehler, chief engineer, Greenfield Tap & Die Div., Greenfield, Mass.; Arthur N. Kugler, chief welding engineer, Air Reduction Sales Co., New York; Raymond H. Meckley, vice president, Flinchbaugh Products, Landisville, Pa.; J. R. Miller, vice president-manufacturing, Dana Corp., Toledo; Richard C. Montanus, vice

president, Springfield Machine Tool Co., Springfield, Ohio; Waldemar Naujoks, chief engineer, Octigan Forge Div., H. & B. American Machine Co., Chicago.

The revision groups' work was made easier by the fact that the first edition had gained so much acceptance and respect in industrial circles. Many who had a hand in getting out the first handbook asked that their names be included in the roster of contributors and reviewers of the second.

Contributors Recruited from Top Ranks

The 387 contributors comprise a complete mastery of tool and manufacturing engineering. They were recruited from the top ranks of machine tool manufacturers, tool and gage manufacturers, equipment and supplies manufacturers, materials producers and processors, general fabricating manufacturers, engineering companies, government departments, technical schools and institutes, and professional societies and associations. Blending these assorted backgrounds, the handbook becomes a melting pot of top knowledge in the tool engineering field.

Not to be overlooked is the vital contribution of the whole Society's membership. Voluntarily, in an effort to help the progress of the publication, many of them made available to researchers their plant files. Every important record and report in these files that might help solve a tool engineering problem was delivered into the hands of the handbook researchers. These contributions were made so that the reader, the tool engineer, could have easy access to modern, necessary data which he couldn't derive for himself in a dozen active tool engineering lifetimes.

The achievements of all tool engineers made such a book possible—and made it necessary.

The outstanding features of the new book were pointed out to some 30 people by the handbook editor of McGraw-Hill, Richard Zeldin, at the presentation ceremonies in St. Louis. Among those present besides President Ewing, were Willis Potthoff, chairman of the NTPC and Frank Wilson, ASTE handbook editor.

The new *Tool Engineers Handbook* is literally five pounds of tool engineering advice, overflowing with trade secrets. Its 2289 pages are priced at $19.50 a copy, $15 to ASTE members.

Textbook Subcommittee Meets

TOOL ENGINEERING is not merely tool design, but tool design is tool engineering.

The ASTE is presently planning to give some first-class recognition to this important function of many of its members. The recognition will come in the form of a tool design textbook, being prepared by the National Technical Publications Committee in cooperation with the National Education Committee.

A recent survey of educators in 368 degree and nondegree schools indicated that their tool design courses are badly in need of a first-class textbook. Many of the educators complained that present texts are usually the work of someone concentrating on a single specialized subject and, as a result, do not have the proper balance of subject matter for a classroom. The Society aims to fill their needs. It has embarked on the task of making an authoritative and balanced textbook on tool design that will also serve as a symbol of one of the many facets of industry that its members represent.

Much discussion of content and format has already taken place. The most recent meeting of the textbooks subcommittee of NTPC (the tool design book is only one of a number of projects in the Society's ambitious textbook program) took place in Chicago Sept. 19, under the chairmanship of Anthony R. Konecny, NTPC member from Cleveland. In their attempt to refine the planning for the tool design text, the subcommittee members reached general agreement that:

- All basic classes of tools should be covered
- The book should fully serve curricular needs of technical institutes and junior colleges
- Availability of a satisfactory tool design text could encourage many schools either to start such a course, or to upgrade their present courses.

While the book would essentially be directed at potential members of ASTE, it would also be useful to present members, according to the committee.

Others in attendance were: from Racine chapter, Howard Heigl and John Kellogg; from Cleveland, Everett Laitala; from Detroit, Robert Nauth; from Milwaukee, Joseph Mundbrot, Ralph Perlewitz and Don Pohlhammer; from Chicago, Bernard Better, Cliff Evanson, Glen Haley, Joseph Kosinski, Michael Romano, Stanley Snorek, George Kurczek and Louis Vargo; from Tri-Cities, Rod J. Taylor and B. D. Wilson; from Madison, James Flaherty and George Sell; from Springfield (Ohio), Andy Anderson. Other national representation included NTPC Chairman Willis J. Potthoff of St. Louis; NTPC Vice Chairman Ray E. Gariss, Long Beach; committee member Ray H. Meckley, York; and ASTE Technical Director Frank W. Wilson.

Chips and Chatter

Chips have an unerring tendency, they say, to fall where they may. A "Chips" column writer in the GREATER NEW YORK bulletin took note of this when he or she ribbed the chapter's "quiet, mild" first vice chairman, Dominick Scolaro. Dom's better half saw pictures, one being of him, which were taken at a national get-together and published in this magazine. Later she asked if there were women at national affairs. When Dom answered, she showed him the picture and the doghouse at the same time, reported the "Chips" columnist. P.S. to Dom: Willkommen to the ranks.

To effect close liaison with the various state Boards of Registration, ASTE members are being named as state representatives. The Society appointees will particularly encourage state boards to include tool engineering questions on registration exams. . . . A simultaneous registration development saw the Society's National Professional Development Committee attend the recent Model Law revision discussions at the annual meeting of the National Council of State Boards of Engineering Examiners (NCSBEE). The ASTE registered its opposition to any law that *required* tool engineers to register, rather than *permitted* them to do so.

QUOTES OF THE MONTH: "We need 158 man-hours of ladies."—W. B. McClellan, reception chairman of the Detroit Host Committee, at a joint planning meeting with the National Program Committee. McClellan meant that members must recruit wives from Detroit and neighboring chapters to man reception desks which will be in operation for 158 busy hours during the national Convention and Tool Show, April 21-28, 1960. All ladies willing to put in some man-hours are invited to do so. . . .

"If we have learned how to make increasingly complex equipment, we have not learned how to make it cheaply. Cost reduction may be the great breakthrough we require to go into space on a grand scale."—Roy W. Johnson, director of the Advanced Research Projects Agency, Defense Department. Johnson's challenge (to cost-conscious tool engineers?) was hurled during his speech at the formal opening of a $5-million Lear, Inc., plant at Grand Rapids, Mich. The new space-age manufacturing facility, appropriately dedicated to the tune of magnified beeps from the orbiting Vanguard III, will have strong representation among the 200 members of Grand Rapids Chapter 38.

Standing beneath the geodesic superstructure of the American Society for Metals' headquarters outside Cleveland, Allan Ray Putnam, ASM's new managing director and ASTE's former assistant executive secretary, receives the master key to the unusual new building. Handing over the key to Putnam is the Metals Society's president, Dr. Clarence Lorig (right). Al Fairchild, a member of the ASTE PIEDMONT chapter and an incoming member of ASM's board of trustees, looks on.

In a talk on "Capital Costs and You," Executive Vice President Carl M. Beach of Heald Machine Co., Worcester, Mass., told MILWAUKEE chapter members that "spending this year's depreciation dollars for this year's equipment at this year's prices" was the best way to meet inflation and federal depreciation rates. No forward-thinking tool engineer can afford to overlook the economy of replacing obsolete equipment as fast as depreciation dollars accrue, he said. Spend now or pay later?

Members in the News

FRANK F. FORD, national director of ASTE and former chairman of Atlanta chapter, has joined with Robert S. Lynch to form Ford-Lynch Associates, consultants and sales engineers, Atlanta, Ga. After graduation from Yale, Ford worked as an alloy metallurgist and sales engineer for Great Lakes Steel Corp., Div. of National Steel Corp., Detroit. He later served as associate professor of chemical engineering at Georgia Institute of Technology. Since 1949, he has founded and directed the development of three different organizations—Frank F. Ford and Associates, Ford Supply Co. and Dixie Engineering and Manufacturing Co.

After 21 years of service with AC Spark Plug Div., GMC, CLIFFORD L. JOHNSON, Saginaw Valley member, has been promoted to manufacturing manager of Hyatt Bearings Div. Johnson was named director of production engineering in 1956, in charge of preparations for the manufacture of some 30 major types of automotive accessories.

Election of RICHARD G. NOLTE, Pittsburgh chapter, to the board of directors has been announced by Duff-Norton Co. Nolte joined the company in 1955 as vice president and assistant to the president. He was appointed vice president and general manager in 1956.

After more than 20 years of manufacturing and sales experience, JAMES A. LEAKE, Toledo member, has been appointed sales manager of the Rockwell-Standard Corp., Stamping Div. Leake is a national director of Pressed Metal Institute. . . . THEODORE A. MILLER, South Bend chapter, has been named resident salesman at Rockford, Ill., by Latrobe Steel Co., working out of the Chicago office. Miller joined the company in 1951, representing the Special Products Div. at Hartford, and served two years at the home office in Latrobe, Pa., as advertising manager. . . . After having served six years as sales representative, assistant branch manager and branch manager with The Carpenter Steel Co., DONALD F. ROSS, Dayton, has been promoted to Dayton-Cincinnati district manager.

The appointment of ROBERT M. DIEDRICH as sales and service representative for the N. A. Woodworth Co. has been announced. Diedrich, who joined the staff of the R. H. Thompson Co., representative for Woodworth, was formerly employed as process engineer and tool buyer for United Aircraft Products, Inc., and prior to that was in the engineering and purchasing department of Airtemp Div. of Chrysler Corp. in Dayton. . . . The New Britain Machine Co. has appointed DUANE E. STEINLE eastern district sales manager of their Lucas Div. Previously, Steinle was Connecticut sales representative for The Pratt & Whitney Co., Inc., and prior to that was with the Detroit office of the New Britain Gridley Div.

WILLIAM G. MOLES, presently serving as membership chairman of the Washington, D. C., chapter, has joined the sales force of Burgmaster Eastern Sales Div. of Burg Tool Mfg. Co. Moles, who started out in the machine tool business with Westinghouse while attending Carnegie Tech, worked for the U. S. Navy as a project engineer for 18 years. . . . HILL PIERCE has been appointed sales engineer in the Detroit office for Leland-Gifford Co. of Worcester. Pierce was formerly with The Cross Co. and Buhr Machine Tool Co.

CHARLES GOOD has resigned his office as secretary for the Chicago chapter to accept a position with Fenestra, Inc. in Philadelphia, for whom he had previously worked for 20 years in their Detroit plant. In his new work, he will have the title of manufacturing engineer in the plant that makes windows and sliding doors. In Chicago, Good was associated with the Ceco Steel Products Corp.

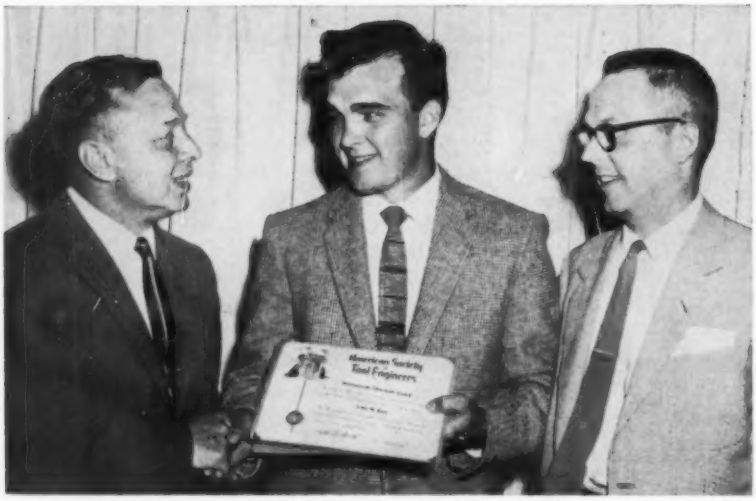
Frank Ford

R. G. Nolte

W. G. Moles

HAROLD C. BURGESS, member of Cleveland chapter and district sales manager for Latrobe Steel Co. for the past 21 years, has been named Ohio regional sales manager for the company. Burgess will have supervision of sales and warehousing in Cleveland, Dayton and Toledo. . . . McBeth Machinery Co. announces the addition of ERNEST C. HAWKINS, Pittsburgh, to its sales staff. Hawkins has for many years been prominent in the machine tool field in the Pittsburgh area.

chapter news and views



Christian Stephan (left), chairman of Chapter 78, and A. V. Payne (right), president of Mohawk Valley Technical Institute, congratulate Louis Gass, recent winner of an ASTE International Education Award.

Mohawk Valley Chapter Helps Meet Challenge of Industrial Upheaval

MOHAWK VALLEY—While looking ahead to a busy fall agenda, which includes a seminar in powdered metallurgy and the establishment of a chapter scholarship in technical education, Chapter 78 pauses to look back—for this year begins its second decade in the Mohawk Valley.

Ten years is bound to change a community somewhat, but in the Mohawk Valley the years since the establishment of the chapter have brought a modern industrial revolution. This locality, like so many American communities, after World War II, fell victim to industrial expansion and relocation.

When textile plants moved from the valley, known until that time as a leading textile manufacturing center, citizens became alarmed. Then came the metalworking industries—a blessing to the community, but a mixed one at first, because a large portion of the population was not trained in the manufacture of metal products, despite the fact that some metalworking plants had long operated in the area. The challenge was met, however, and the programs and seminars of the Mohawk Valley chapter played no small role in nurturing the progressive technical competence of the local industry personnel.

The past decade saw the establishment of Mohawk Valley Technical Institute as a state institution under New York State University, the chartering of a MVTI student chapter and continuous cooperation between Chapter 78 and the Institute. Chapter members frequently act as part-time faculty members, while representatives of the Institute's administrative body and faculty regularly attend chapter meetings. Two Institute students have won ASTE International Education Awards, one each year of the competition's existence.

The diversified technical skills of MVTI graduates represent the diversification of Mohawk Valley industry. In 1958 the chapter seminar on automation aptly demonstrated this array of local industry; topics ranged from mechanized and automated stamping and forging techniques, applicable to local metalworking industries, to automation of small lots processing used in local electronics plants.

The important job of the Mohawk Valley chapter has been and is to encompass the diversified requirements of its community by disseminating the scientific knowledge involved in tool engineering in its broadest concept.

—F. J. Rotundo

Baltimore Speakers Cite USSR Gains In Machine Tools

BALTIMORE—Two speakers on manufacturing in Russia keynoted the September meeting of Chapter 13. Dimitri Shimkin, Census Bureau expert on the Soviet economy, emphasized Russia's rapidly increasing production of machine tools. It has grown so within the past two decades that it now stands higher than that of the United States.

Leon Herman, of the Library of Congress, explained how these advances in Soviet industry may affect standing among the Communist and capitalist nations.

Dr. Shimkin reported that machine tool production in Russia soared from about one-third that of the United States in 1937-39 to approximately the same in 1956. During this time the major item in Soviet production was heavy cutting tools, while finishing and polishing tools predominated here. However, Shimkin said, in close control or advanced production systems no reliable figures are available to indicate the relative positions of the two countries.

ORLANDO—Since this presentation of the charter to Chairman John Maiberg by ASTE President Wayne Ewing in June, Chapter 160 has been proving itself more than worthy to carry the ASTE banner. The past two meetings in August and September have been highly successful, not only because of the excellent speakers but also the high attendance rate, which has been approximately 75 percent at both meetings. A drive to increase the Orlando chapter's membership is also underway.

Directory Available In Single Copies

Many single copies of the recent Suppliers Directory, June 15 issue of THE TOOL ENGINEER, are now available to ASTE members at only $1.50 per copy. For nonmembers the price is $4.50. Also a special rate of $2.50 per copy is being offered to schools and libraries. To purchase these directories, write the circulation department at national headquarters.

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60 from North Texas Tour Steel Factory And LeTourneau Plant

NORTH TEXAS—The study of manufacturing operations through plant tours recently provided Chapter 51 with an interesting and educational day. A group of 60 members first visited the R. G. LeTourneau Corp. plant in Longview, Tex., where the company president and city mayor were on hand to greet them. Next, they journeyed to nearby Dangerfield to tour the Lone Star Steel Co. plant. Here members observed and studied the latest developments in steel-mill operations.

Following these tours, the plant managers or members of the plant engineering and manufacturing staffs held question and answer sessions, which enabled chapter members to learn more about the plants' facilities and operations. *—Edwin T. Wellman*

Toledo Will Award Three Scholarships

TOLEDO—To advance the profession of tool engineering, three scholarships—one for $200, two for $50—will be awarded to University of Toledo students on Chapter 9's Industry-Education Night, Nov. 11. The speaker will be a nationally prominent sports figure, James (Rip) Collins, four-time National League All-star, who played in the 1931, 1934 and 1938 World Series. *—Bob Gregory*

Executive Night Set for November

BOSTON—The Massachusetts Institute of Technology's graduate house will be the scene of Chapter 33's annual executive night. The date, Nov. 19, will fall on the third Thursday of the month, the new time for all regular chapter meetings of the Boston group.

This change in the scheduling also goes for executive committee meetings. Formerly, these gatherings were held on the Monday following the second Thursday of the month, the old time for regular meetings. Under the new policy, executive committee meetings will fall on the Monday following the third Thursday of the month. Nicholas Juliani, chairman of the Boston chapter, feels this new setup will prove more convenient to the members, and in turn increase attendance at chapter meetings.

Welcoming Ben Harris, chairman of North Texas Chapter 51, to the R. G. LeTourneau Corp. is company president, R. G. LeTourneau. Others shown (left to right) are: Irving H. Buck, national director ASTE; Reid Jamison, chapter vice chairman; D. A. Benton, mayor pro tem of Longview; Wayne Johnson, chapter secretary; Paul Orbison, treasurer; and Herman Vibrock, chairman of plant tours.

Muncie

Approximately 50 members and guests participated in a plant tour of Ex-Cell-O Corp., Elwood, Ind., Sept. 18. After a welcoming speech by Roy Bray, plant manager, they were shown some of the broaching, milling, grinding and polishing operations, and gaging of the airfoil. The plant is unusual in that it produces only one product, with most of the milling and grinding operations being performed on Ex-Cell-O machines.

Indianapolis Speaker Illustrates Program Control Advantages

INDIANAPOLIS—In a field where cost reduction is an important consideration, program control is a significant topic. This timely subject was defined and explained at the September meeting of Chapter 37 as Rosco B. Jones, program control market specialist for General Electric Co., spoke on flexible automation with program control.

Defining program control as the name given to equipment which provides automatic control of machines or processes from information previously stored in the form of templates, punched tape, punched cards or magnetic tape, Jones briefly described three general categories of such control. The first was tracer control in which the information is stored in a template for the automatic control of the continuous path of a machine motion. Numerical positioning control, the second, provides automatic control of point-to-point motions of a machine from information stored on punched cards or on punched paper tape. In the third, numerical contouring control, the information is stored on magnetic tape to provide automatic control of the continuous path of a machine.

Numerical control, the speaker told the 70 members present, makes possible complete machining of a part with only one setup; thus, it eliminates expensive tooling, reduces inventory and in turn produces savings.

The accuracy of machines which are numerically controlled depends primarily on the machine design; secondarily, it depends on the accuracy of the position feedback, which is usually two to four times the accuracy required in production.

In evaluating the cost of numerical control, Jones urged the chapter to keep in mind the basic system concept —value added by a system approach results in the total value being greater than the value of individual components. Measures of value added to a machine tool are generally based on the value produced or on the cost savings resulting from increased production.

To illustrate this point, Jones stated that a $25,000 lathe is purchased to position a $5 chunk of carbide; but, he added, its price is evaluated by the value it adds to the production process, not by the relative cost of lathe and tool. Likewise, a numerical positioning control packaged system which adds $15,000 to the cost of a $25,000 machine may permit sufficient cost savings to pay for both control and machine in two years or less. —*Robert R. Huser*

LONG ISLAND—Emphasizing a point in his talk on "Space—Man's New Frontier," is Robert Colwell of New York Telephone Co. Speaking at the September meeting, Colwell, who is a communications consultant, used the models at left to demonstrate his talk to the 190 members present. —*Warren A. Lipman*

Niagara District

"New Developments in Coated Abrasives" was the subject covered by J. L. Call of The Carborundum Co. at the first dinner meeting of the season, Sept. 10. His subject covered from the 13th century to the present the many different types of abrasives and bondings in use. Also the proper application of contact wheels when used with coated abrasives was shown on film, followed by a lively question and answer period.

LANSING—A. Juras, president of Plastic Development & Research Inc., Detroit, was the guest speaker at the September meeting of Chapter 109. His topic, "New Techniques for Construction of Plastic Tools," included a description of plastic-faced plaster, which combines the economy of plaster with the hardness, toughness and durability of metal fiber plastic. —*R. J. Krumrie*

Past President Osborn Is Guest Speaker At Keystone Chapter

KEYSTONE—At the September dinner meeting of Chapter 101, Harry B. Osborn of Cleveland, past national president of ASTE, presented to Theodore Tomaszewski of Pennsylvania University Center, Scranton, a certificate of commendation for being awarded one of the national ASTE scholarships.

Entitling his talk "Principles of Induction Heat Treating," Dr. Osborn briefly traced the history of this industrial art. He compared motor generators and vacuum tube oscillators, pointing out their respective advantages, disadvantages and limitations. "In many instances," Dr. Osborn reported, "power density was a more important factor than frequency"; and in numerous cases "to go deeper (with hardened case) is to make it cheaper."

Although the primary purpose for the development of induction heat treating is to provide a hardened surface for wear resistance, Osborn explained that a hardened skin with a softer core considerably increases fatigue resistance. In many applications this reduces cost by permitting the substitution of a lower price steel.

Stanford Jones, Keystone chapter chairman, announced that THE TOOL ENGINEER is being sent to the following schools and colleges: Pennsylvania University Center, University of Scranton and Johnson Trade School in Scranton; Pennsylvania University Center, Wilkes College and Kingston Technical Institute in Wilkes-Barre; and Keystone Junior College in La Plume, Pa.

Also attending the dinner were Samuel Kuba, member of ASTE's National Membership Committee, and William Nichols, past chapter chairman.

Author Lovejoy Dies in Hartford

HARTFORD, Conn.—Stanley W. Lovejoy, manager of engineering research, Cutting Tool Div. of Pratt & Whitney, died Sept. 9 after a brief illness. He joined the Society in 1941. First a member of the Boston chapter, he later joined the ASTE group in Hartford.

Educated at the Massachusetts Institute of Technology and the Lowell Institute of Technology, Lovejoy worked with Oscar E. Koehler's industrial revision group 7, which prepared the screw thread design and production section of the second edition of the *Tool Engineers Handbook*. He is also author of a number of articles published in industrial trade publications.

Catskill Region Hears Talk on Jig Borers

CATSKILL REGION—Modern methods of tape-controlled production developed in the past year have increased the output of jig borers by five times, stated Bruce Lockway of the Fosdick Machine Tool Co. in his lecture on "Numerically Controlled Jig Borers" at the September meeting. Most jig borers, he reported, are currently earning $10-$12 per hour of production.

Jig borers are machines used for cutting ultraprecision holes in plates and castings; the tape control, an expensive accessory, feeds instructions automatically to the machine. Operations that can be controlled by punched tape, said Lockway, are positioning, boring, setting speeds and feeds, and tool changing.

Surprisingly, many orders for tape-controlled jig borers come from small shops whose total value does not equal the machine's cost. This, Lockway explained, enables the small shops to remain competitive. The speaker also presented color slides depicting the tape-controlled jig borers.

—Kenneth W. Sandberg

Peoria

One-hundred-twenty-four members and guests were well repaid for their 130-mile trip to Maquoketa, Iowa, for the annual tour of the Clinton Machine Co., manufacturers of small 2 and 4-cycle "Clinton" gasoline engines. After dinner at the plant, the visitors viewed all phases of machining and assembly.

The seven past chairmen who attended the September meeting especially planned for them pose with the present chairman of the Boston chapter, Nicholas Juliani. Left to right are Wilfred B. Wells, Juliani, Charles L. Sadon, A. F. Leone, John L. Morosini, Karl G. Nowak, Arthur A. Nichols, and John X. Ryneska.

KU Adds Four Courses In Tool Engineering

UNIVERSITY OF KANSAS—The faculty adviser of Student Chapter 3, Prof. Paul G. Hausman of the school of engineering and architecture, has announced the introduction of an optical tooling unit to a course in precision measurement and inspection. The University of Kansas has also included in the fall semester's curriculum four new courses connected with tool engineering. They are: industrial safety, automation in manufacturing, manufacturing analysis, and industrial models and patterns.

Past Chairmen Honored At Boston Gathering

BOSTON—Seven past chairmen and other members of Chapter 33 heard D. R. Percival, president, and F. P. Dunigan, vice president, Machinery Electrifications of Northboro, Mass., discuss the products turned out by their firm.

The representatives of the company, which grew from a basement shop to a modern factory with 45,000 sq ft of operating space, told of the types of electrical control equipment they produce, such as power distribution control systems, and custom-engineered controls for machinery and processing equipment, as well as a standard line of electric control devices. This line includes load control units, photoelectric counters for linear measurement and multichannel control units for automatic warehousing. *—Lester Horne*

HENDRICK HUDSON—A pair of winners are congratulated at a meeting of Chapter 114. (Left to right) Gerald Hamme, chairman of the chapter, commends Edward Cerkowski of Hudson Valley Technical Institute, upon his acceptance of an ASTE International Education Award. A *Tool Engineers Handbook* went to Philip Kleisler for his competence in machine and tool design. Making the presentation is Jim Kiernan, chairman of the chapter's education committee. *—Raymond A. Brooks*

Three Chapters to Hold Combined Meeting

SCHUYLKILL VALLEY—Three ASTE chapters, all in Pennsylvania, will hold a combined meeting on Nov. 10. The meeting will be devoted to a discussion and demonstration of gas turbine engines. Taking part will be the Schuylkill Valley, Lehigh Valley and Greater Lancaster chapters.

Knoxville-Oak Ridge

On Sept. 1, 54 persons toured the plant of Bowaters Southern Paper Corp. in Calhoun, Tenn., one of the largest newsprint mills in the world. Knoxville-Oak Ridge members participated.

St. Louis Chapter Visits Springfield

ST. LOUIS—"Meet Me in St. Louie" gave way to "Meet Me in Springfield" when Chapter 17 recently traveled by bus, car and plane to the nearby Illinois community for a plant tour and technical talk.

On arrival the group was greeted by Robert Woods of the Springfield chapter, who introduced them to William Mullaney, training director at Sangamo Electric Co., Springfield. After Mullaney explained Sangamo's products and operations, the St. Louis chapter toured the plant in small groups conducted by guides.

The main product of the Sangamo Co., which manufactures a variety of electrical measuring instruments and related products, is watt-hour meters. All the components of these meters, except the glass cover and sapphire jewels, are made in their plant. Operations include: machining, presswork, diecasting, plastic transfer and compression molding, encapsulating, coil winding and wire bending. Watt-hour meters must be accurate and reliable enough to have a service life of 15 years; therefore, cleanliness in manufacturing and tool storage areas, as well as precision in manufacturing tools, are of prime importance.

Following the plant tour and dinner, the St. Louis and Springfield chapters were addressed by E. A. Leach, vice president in charge of engineering at Sangamo. He explained the company's tooling policy, which is geared to meet the competitive demands of their product. In considering tooling or machinery expenditures, careful cost studies are made to determine how long an investment will take to amortize itself; the time usually required is 18 months or less. However, hard and fast formulas are not always followed, said Leach, who cited some instances in which improvements based on intuitive judgments had worked out successfully.

—Lyle R. Perry

Ben Wallis (left), Detroit chapter chairman, and Henry Daum (right), program chairman, are shown with guest speaker Thomas Morrow of Chrysler Corp.

The September meeting of the Long Beach chapter also saw the welcoming back of that group's charter chairman, John Stansbury (left), absent for a long period due to an operation. President Wayne Ewing and Irv Also (center), chapter chairman, brief Stansbury on new chapter plans and proposals.

Ithaca

At the technical dinner meeting Sept. 8, approximately 95 members and guests heard E. M. Brockway, quality control engineer at Bausch & Lomb Optical Co. Brockway's narration, supplemented by slides, described the utilization of microscopes, telescopes, projectors and linear instruments in using optical methods and procedures.

Combined Meeting Draws Detroiters

DETROIT—Combining the September technical meeting with Past Chairmen and Plant Representatives Night, Chapter 1 drew to its first meeting of this season an attendance of 310 members, including 12 past chairmen, and 54 plant representatives. The speaker, Thomas F. Morrow of Chrysler Corp., covered the timely subject, "Production of Reliable Ballistic Missiles."

As vice president of defense and special products, Morrow is responsible for the corporation's missile operations, tank production and special products group. His extensive work experience there includes positions in tool engineering, manufacturing and experimental engineering, and planning.

Relating how production techniques can stay abreast of the fast-moving technology of missiles, Morrow noted the problems and challenges of this advancing field. Movies were shown and followed by a question and answer period.

"We should consolidate programs more often; interest is keen," commented Joseph Wrobel, first vice chairman of the chapter, to Henry Daum, chairman of the regular program committee who planned the evening.

—Cass Wrobel

Technique, Economics Of Explosive Forming Heard at Long Beach

LONG BEACH—The story of a new high-energy forming process, explosive forming, was told to 123 members of Chapter 84 at their September meeting. Floyd Cox, manager of the manufacturing research and development department at Ryan Aeronautical Co., San Diego, was the narrator.

Cox began his talk, which he illustrated with training aids, by informing the audience of the basic requirements necessary for this process—vacuum, waterhead and an explosive charge. He added that the products turned out by explosive forming are being used to overcome manufacturing obstacles of modern aviation and missile space probes.

Conventional die forming methods, Cox stated, can exert 6000 pounds psi. But the explosive technique exerts 60,000 pounds psi and is able to move material 1000 feet per second. In this new high energy forming there is less than 0.002-in. metal thickness variation, Cox said.

The speaker also brought out comparisons in cost of the two methods. A conical part used in the intake section of the DC-8 Jetliner motor was produced by conventional methods in five pieces, then welded for $135. The same part is now being produced in a single piece at a cost of $15. This same conical part consumed eight man-hours with the die method. The new process required only one-quarter man hour to produce this item.

Industry is running out of pressure necessary to work the hardness of the exotic materials required in present-day manufacturing, Cox said. High-energy explosive forming seems to be one answer to the problem.

—Paul J. Bodnar

Purdue's Lascoe To Address Chapter

FORT WAYNE—"The Need for Manufacturing Engineering Training" will be the theme for the Nov. 11 meeting of Fort Wayne Chapter 56. Speaker for the evening, O. D. Lascoe, professor of industrial engineering at Purdue University and faculty adviser of the student chapter there, is well-known for his work in establishing the machine tool laboratory at Purdue. He has also made valuable contributions to the advancement of the machine tool industry and to many of the widely used technical books relating to the industry.

—John F. McComb

Tucson Seminar to Plan For Space Age Tooling

TUCSON—On Nov. 13 and 14 Chapter 106 will put its "Space Age Tooling" seminar into orbit at the University of Arizona. Noted educators and top-flight engineers will discuss and present papers on the materials, gaging, and machine and cutting tools for the mechanical, electronics, chemical and thermodynamic fields.

A panel forum will bring together the views of industrialists and educators on "Preparing Engineers To Cope with the Problems Created by the Exotic Metals of the Space Age." Industry's half of the panel will be comprised of representatives from companies involved in the manufacture of products affected by the advancements of the space age. On education's side of the panel will be: Dean Drought, college of engineering, Marquette University, Milwaukee; Dean Thompson, college of engineering, Arizona State University, Tempe; Dean Martin, college of engineering, University of Arizona; and Frederick Praetor, tool engineering department head, Utah State University, Ogden.

Dean Drought will speak on "Courses Designed To Teach Tool Engineering from a Scientific Point of View," and a representative of Cincinnati Milling Co. will discuss "Electrical Discharge Machining." Papers on "Tooling for Semiconductors and Advancement in Tape Control of Machinery" are to be given by engineers from the various divisions of the Hughes Aircraft Co., Tucson.

Three Milwaukee speakers will discuss "Machining of Reactor Materials": A. O. Schmidt, chief engineer of metal-cutting research at the Kearney & Trecker Corp. and research professor at Marquette; B. L. Richardson, assistant professor at Marquette and chairman of their nuclear engineering committee; and J. R. Roubik, research engineer at the Kearney & Trecker Corp.

SAN GABRIEL VALLEY—Demonstrating the properties and characteristics of natural gas with custom-built portable equipment and special lighting effects is J. C. Byrne, public relations representative from Southern California Gas Co. He addressed the members of Chapter 95 at their September technical meeting.
—Bernard K. Allen

Metal Joining Theories Told at Greater New York

GREATER NEW YORK—Howard Gans, New York State regional manager of Eutectic Welding Alloys Corp., Flushing, spoke to 95 members of Chapter 34 on the theory and practical application of "The Latest Metal-Joining Developments."

A film entitled "New Welding Procedures" and the speaker's liberal use of the blackboard clarified many of the new techniques developed by the Eutectic firm. Four actual demonstrations of joining similar and dissimilar materials at temperatures far below the melting point of the respective materials were performed, provoking an extended question and answer period.

This September gathering was a combination technical meeting and past chairmen's night. *—Alfred M. Sampter*

Position Wanted

PLANT MANAGER or ASSISTANT TO PRESIDENT—Production, personnel, purchasing, tooling, quality control, subcontracting, administration, labor-management relations. General manager for seven years in growing plant. Miniature electro mechanical components. Extensive industrial diamond background. Graduate industrial engineer. Fluent German. Will take European assignment. Write to Classified Ads, Dept. 163, 10700 Puritan Ave., Detroit 38, Mich.

Positions Available

METAL FINISHING SPECIALIST—Young college graduate, chemist or engineer preferred. Wanted for development and promotion of processing oils and lubricants to be marketed to metalworking industries. Position offers unusually attractive growth potential with nationally recognized Eastern United States oil refiner expanding into new field of activity. State full background, education, experience, and salary requirements. Write to Classified Ads, Dept. 164, 10700 Puritan Ave., Detroit 38, Mich.

NEW INDUSTRIAL SUPPLY HOUSE—headquartered in El Paso, Texas, solicits franchise manufacturers agency or distributorship for West Texas, New Mexico, Arizona and Mexico. Write to Classified Ads, Dept. 162, 10700 Puritan Ave., Detroit 38, Mich.

MANUFACTURING ENGINEER—Three or more years' experience in tooling and methods determination, plus an engineering degree, will qualify you for this exceptional opportunity. Should be familiar with manufacturing processes of precision machine parts from drawings through finished products. Knowledge of operation sheets, forgings, castings and hydraulics desirable in the aircraft industry. $8000-$9600 plus profit sharing in an expanding suburban Buffalo engineer-directed company. Write to: Moog Servocontrols, Inc., Manufacturing Engineer, East Aurora, N. Y.

WANTED—Established Manufacturing representatives now selling the tooling industry, to sell formulations of epoxy tooling resins in Northern Illinois, Ohio and Indiana for a strong, national and well-known manufacturer. Write to Classified Ads, Dept. 165, 10700 Puritan Ave., Detroit 38, Mich.

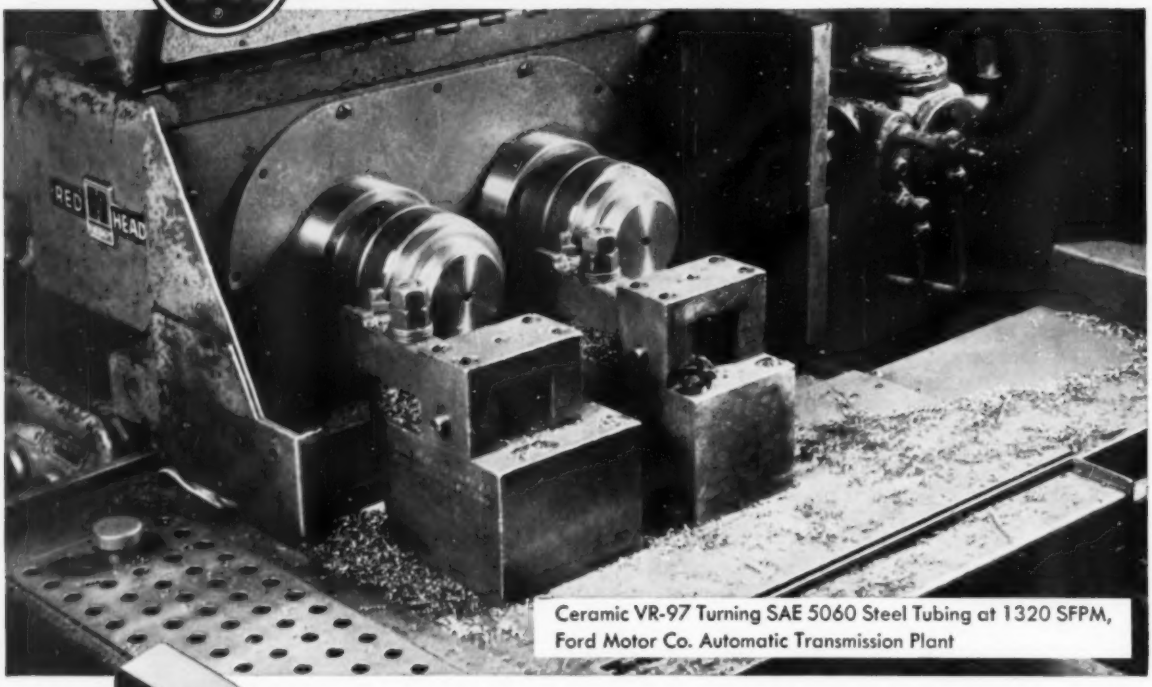
SPECIAL EVENTS

ASTE Seminar—"Some Problems of Machining Space Age Metals"	Nov. 17-18	Sheraton Hotel, Philadelphia, Pa.
ASTE Seminar—"Numerical Control in Creative Manufacturing"	Nov. 17-18	Sheraton Hotel, Philadelphia, Pa.
ASTE Seminar—"Metal Forming Methods for Tomorrow's Manufacturing"	Dec. 3-4	LaSalle Hotel, Chicago, Ill.
ASTE Seminar—"Numerical Control in Creative Manufacturing"	Dec. 10	Bond Hotel, Hartford, Conn.
ASTE 28th Annual Meeting	April 21-28, 1960	Statler Hilton and Sheraton Cadillac Hotels, Detroit

Monadnock

Milton A. Holland, director of research for the Union Twist Drill Co., spoke to 55 members and guests at the Sept. 17 meeting. His subject, "Drilling High-Temperature Metals," covered problems peculiar to the metal processing plants, suggesting new methods of drilling more difficult to machine metals in higher nickel alloys.

Ceramic VR-97



Ceramic VR-97 Turning SAE 5060 Steel Tubing at 1320 SFPM, Ford Motor Co. Automatic Transmission Plant

Proven in production at Ford Motor Company

Ceramic VR-97 is a proven performer in many machining operations at the Ford Motor Company's Automatic Transmission Plant, Livonia, Michigan. Here, and in hundreds of other progressive plants across the nation, VR-97 has been proving its value on continuous production runs. People who considered ceramic tooling as merely "experimental" a short time ago now rely on ceramic VR-97 as an important part of their production picture.

Whether you are interested in increased machine output, higher speeds, better finish or machining hardened steel and cast iron, it will pay you to know more about ceramic VR-97. Contact your nearest V-R representative or write for complete information.

Ask for Product Information BULLETIN NO. 59.1 covering Ceramic VR-97.

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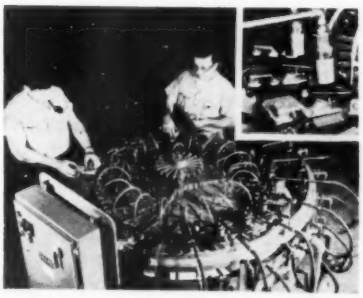
Progress in Production

AUTOMATED BRAZING INCREASES PRODUCTIVITY

A self-indexing machine, which silver brazes a tube and flange to a tank, has increased production to a rate of 600 assemblies per hour while achieving substantial savings for a leading automobile manufacturer.

Each of two such automatic units, designed and built by Selas Corporation of America, Dresher, Pa., has 20 stations for loading, heating, cooling and automatic unloading. The water-cooled, workholding fixture at each station holds the tube and flange in proper relationship with the tank. A device for maintaining alignment of the flange exerts pressure to hold location when the brazing alloy melts. With accuracy of location assured, the only operations requiring manual attention are loading, fluxing and braze alloy preplacement, functions easily handled by two operators.

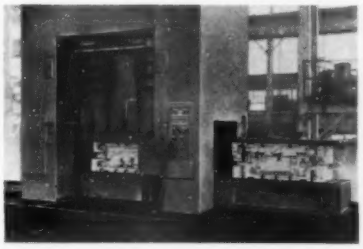
A special gas-air burner, which combines positive flame geometry with maximum heat release, is used at each heating station, one firing from above, one from below. The multiport screen of the burner breaks the flame front into a large number of small flames and produces a concentrated "flat face" round flame of high intensity, thereby combining heating uniformity with the rapid production rate.



Semiautomatic brazing machine produces 600 units per hour.

SLIDING BOLSTERS SPEED DIE CHANGES

Presses designed for fast die changes are being produced by the E. W. Bliss Co., Canton, Ohio. The design permits a variety of parts to be made on a single line of machines without excessive downtime for changing die sections.



Bliss underdrive link press is equipped with two movable bolsters.

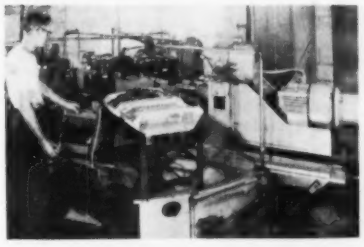
Two movable bolster plates can be rolled out through openings in the uprights of the press so that one is easily available for die change by overhead cranes while the other is in production. With a new die in place on the inactive bolster, die changing involves the rolling out of one die and the rolling in of another.

Die space in the press is automatically set within one thousandth of an inch by an electronic slide adjusting system, and the new die is clamped instantly to the slide, with electropneumatic die clamps. It is estimated that changing dies in a complete line of presses will take minutes, compared to the hours required at present.

AUTOMATED MACHINING OF WELDING FLANGES

Automatic drilling and tapping of eleven different sizes of welding flanges is accomplished by a single high-production machine at the Pressed Steel Tank Co., Milwaukee, Wis. The unit type machine, equipped with a 24-in. diam horizontal rotating table, has saved 50 percent on both time and labor in the production of parts for ⅛ to 2-in. pipe.

The four-station machine, manufactured by The Morris Machine Tool Co., Cincinnati, Ohio, replaced operations on radial drill press. It has three eight-in. way type hydraulic slide units with two-spindle heads to achieve the unusual flexibility required for easy changeover between sizes. At the same time, however, accuracy of tapping depth is held within one-half turn.



Rotary index machine for drilling, reaming and tapping of welding flange.

Clamping and unclamping are air-powered and the fixtures are designed for the processing of two parts simultaneously. The sequence of operations is: Station 1, load two parts; Station 2, core drill and chamfer with a combination tool, or drill and chamfer with a combination tool, according to the requirements of the part being machined; Station 3, taper ream for pipe tap, both parts; Station 4, pipe tap both parts. Cycle time varies, depending on the size of the parts, which are AISI-C1020 steel forgings.

Changeover problems are minimized, despite the extensive range of sizes produced on the machine. In some situations, time for changeover can be held to as little as three hours. The drill and ream spindles have speed adjustment through varidrive motors. The

M1238-1818 — *Range 18" x 18", working distance 9" to infinity. Reads to 0.001" up to 24" working distance. Protractor ocular reads to 3 minutes of arc. Image is erect.*

Cut inspection time in half

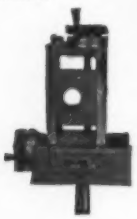
with new Gaertner Coordinate Cathetometers

These convenient, reliable optical instruments permit making precise coordinate measurements in a vertical plane. The two dimensions are measured with one setting, object does not have to be rotated. Inspection time is cut in half and resetting errors eliminated.

Versatile Gaertner Coordinate Cathetometers are ideally suited for precision measurements on large objects; also objects or points in recessed, remote, or inaccessible locations. Applications include measuring jet engine sections, complicated castings, printed circuits, bolt holes and bosses on large piece parts, traces on cathode ray tubes, etc.

Because these are optical rather than mechanical measuring instruments, you make non-destructive measurements without contact, distortion, or concern about pressure being applied to the object when making a setting. Instruments available in English or Metric system.

M1236-46— Horizontal range 6", vertical range 4". Reads to 0.0001", working distance 5" to infinity.



M1236-22— Range 2" x 2", reads to 0.0001". Working distance 5" to infinity. Shown with 19 mm mounting rod, and without telemicroscope. Instrument permits precise coordinate movement of other objects such as photo cells, probes, etc., in place of telemicroscope.

Write for Bulletin 188-53 & 194-57

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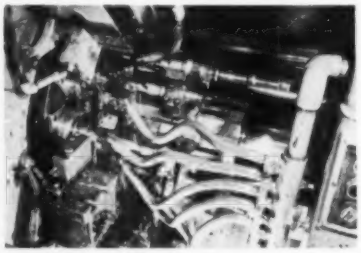
tapping unit is equipped with pick-off change gears, easily accessible through the rear of the head. All units have variable feed rates controlled at the hydraulic panel.

COMBINATION CUTTING OIL AND MACHINE LUBRICANT

Cutting oil which doubles as a screw machine headstock and gearbox lubricant has effected a 50 percent savings at Nippert Electric Products Co., Columbus, Ohio. Screw machines are used in the manufacture of steel cores, lock rings and lock nuts for commutators and slip rings. Materials specified for commutator parts include Ledloy and leaded C-1116, C-1117 and C-1036 steels, and brass.



Acme-Gridley six-spindle machine produces customer commutators.

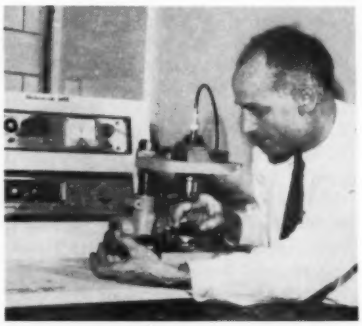
Used extensively in missile applications, the commutators have stringent tolerance and finish requirements. Normally a wide range of cutting oils is required. In experimenting with various coolants, Nippert found one cutting oil which was satisfactory for cutting purposes in the specified range of materials and met the requirements of a machine lubricant as well. The cutting oil, Gulfcut 41C, is formulated with additives of sulfur, chlorine and fatty oils. These additives combine to prolong tool life by preventing particle build-up at tool cutting edges. This antiweld action, along with the secondary cooling function, gives the tolerances and finishes required.

Nearly perfect filtration is necessary in a universal oil if minute particles are to be prevented from eroding the machine gears. Ordinary filtration can ruin the additive balance in the oil, so magnetic filtration is used. A porous bronze filter added to the magnetic filtration system removes all solid contaminants above one micron in size.

GAGE DETERMINES PLATING THICKNESS TO MILLIONTHS

A gage for measuring thickness of metal plating, sensitive enough to indicate differences of one-millionth of an inch, has been developed by manufacturing research engineers at Boeing's Aero-Space Div.

The new gage, actually two gages in one, utilizes long-known electrical and and radiation principles. One portion of the instrument measures capacitance changes; the other measures the intensity of beta-ray reflection. From this combination the entire device has been named a Mag-ray gage. The thickness of a ferromagnetic plating, such as nickel, is measured through the use of magnetic force. A magnet attached to a small spring deflects the spring when the magnet is placed close to the nickel plating. The spring deflection is measured by a capacitance meter which, after calibration, indicates the thickness of the plating. Nonferromagnetic platings such as rhodium are measured by a beta-ray technique wherein the rays are focused on the material to be measured. The amount of the ray that is reflected indicates the plating thickness.



Capacitance change and beta-ray reflection are utilized in Mag-ray gage to measure millionths of an inch.

The gage was developed for determining plating thicknesses on timer disks for Bomarc missiles, in which both nickel and rhodium platings must be measured. Future applications could include measurement of ceramic coatings, paint and other thin skins.

IMPROVED CUTTING TOOL FOR STAINLESS STEEL

Development of a new cutting tool by Spring Garden Institute, Philadelphia, will solve a problem vital to the building of a 2500 mph airplane.

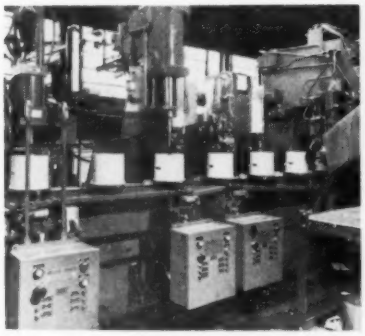
This problem presented itself when aeronautical engineers found that aluminum could not withstand the heat and stress generated at supersonic speeds, and substituted stainless steel alloys. The new alloys work harden as cutting pressures are applied. After experi-

mentation, a milling cutter of copper-impregnated powdered iron with locked-in carbide and ceramics was developed. This cutter has long tool life, surpassing other cutters by a factor of about twelve to one. Other advantages are reduction of vibration, less setup time and smoother finishes. Farnham Div. of Wiesner Rapp Co., Inc. will market the new tool.

ROLL HARDENING IMPROVES BEARING SURFACES

"Bearing surface conditioning" is an important aspect of garbage grinder production at General Electric's Appliance Park near Louisville, Ky. The units are manufactured on an automated assembly line. Each unit is tested for sound, vibration, wattage input and functioning of the magnetic field. Inferior bearings have an adverse effect on any of these functions.

To obtain specified tolerance and surface finish, General Electric uses a tool called a Bearingizer, manufactured by Cogsdill Tool Products, Inc., Detroit. The Bearingizer is a rotating tool with a series of cam-actuated hardening rollers around its periphery. These rollers peen and work harden the bearing surface, holding a dimensional tolerance of 0.0006 in. and a surface finish tolerance of seven micro-inches.



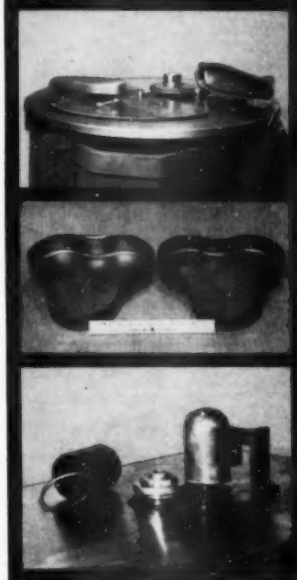
Rotating tool sizes and work hardens bearing surfaces of garbage grinder.

The operation is performed at the third station of a six station automatic assembly machine. Bearings are loaded into the housings of the first station, pressed into place at the second station and finished at the third station. Mounting hole drilling with multiple-spindle drill attachments occurs at the fourth and fifth stations. Motor assembly takes place at the sixth station.

Elimination of the grooves and pressures incidental to roll, ball or mandrel-sizing has resulted in smoother performance and longer life in bearings finished by this process at General Electric.

LOOK WHAT YOU CAN DO WITH A BEATTY-QUICKWORK STAMPING TRIMMER

STAMPINGS before and after trimming



Trim — bead — form . . . up to 500 blank stampings per hour! The Beatty-Quickwork Stamping Trimmer is the versatile metal working machine that provides a short-cut method to speed the finishing of sheet metal stampings.

On either short runs or production jobs, this multi-purpose machine eliminates the need for expensive trimming dies — saves press time — requires minimum floor space. It trims even intricate shapes fast and accurately without burr; beads and forms in the same or separate passes.

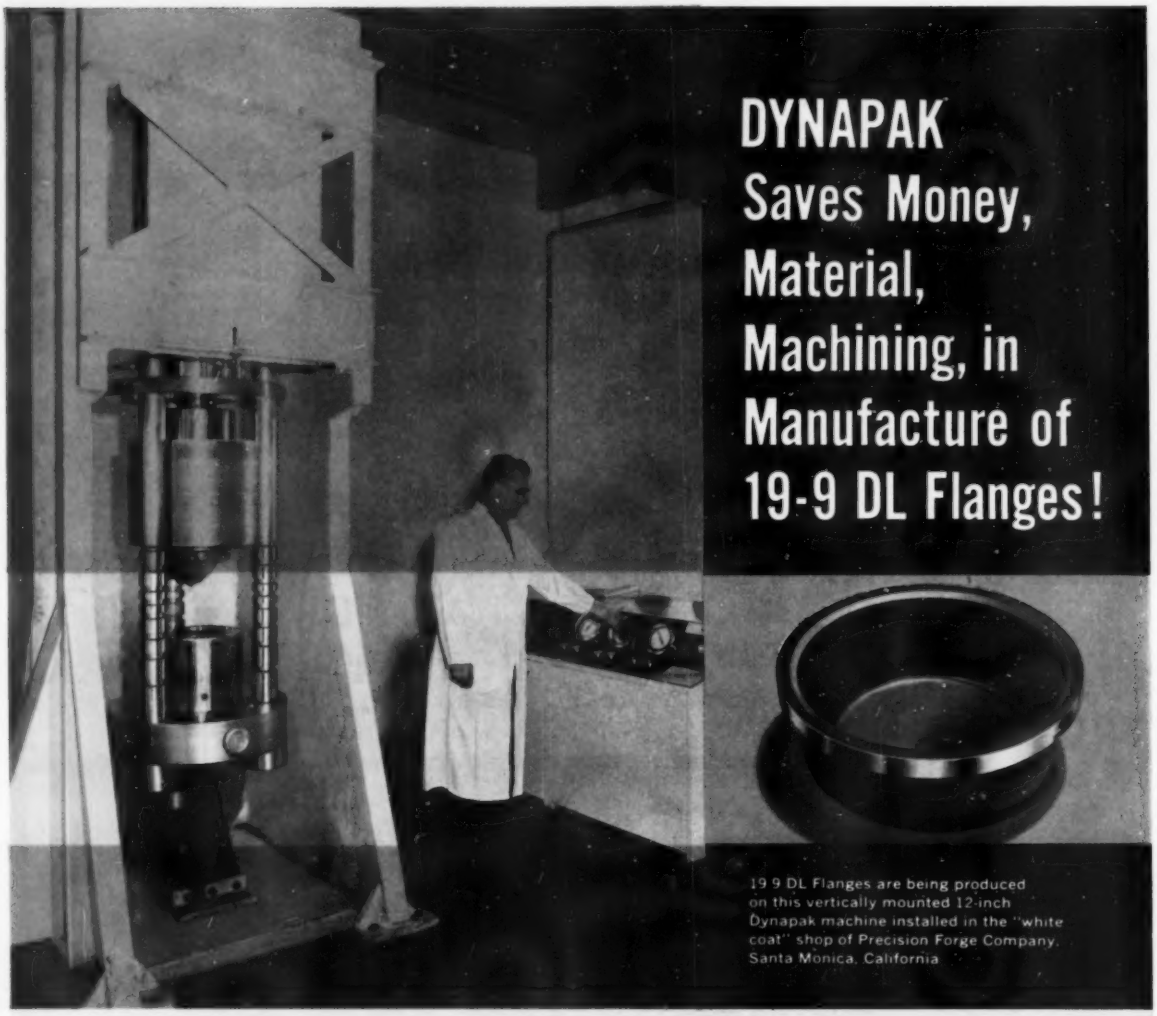
Standard, heavy-duty and special models offer wide range of size and speeds — handle up to 3/8" mild steel.

ONE OF THE BEATTY FAMILY OF METAL WORKING EQUIPMENT: Shears, Punches, Presses, Spacing Tables, Bulldozers, Stamping Trimmers

WRITE TODAY FOR COMPLETE DETAILS

BEATTY-QUICKWORK DIV.
BEATTY MACHINE & MFG. CO.
900 150th St., Hammond, Ind.

USE READER SERVICE CARD, CIRCLE 58



DYNAPAK Saves Money, Material, Machining, in Manufacture of 19-9 DL Flanges!

19 9 DL Flanges are being produced on this vertically mounted 12-inch Dynapak machine installed in the "white coat" shop of Precision Forge Company, Santa Monica, California

Here are the savings achieved in this Dynapak Application:

- MATERIAL: 60%
- TOOLING: 50% of the cost of conventional forging dies
- MACHINING: Reduced by more than 50% due to forging tolerances of $\frac{1}{32}$ in. and elimination of draft angle.

PLUS

- PRODUCTION RATES: 70-80 per hour
- SUPERIOR PHYSICAL CHARACTERISTICS: Greater strength, uniform and controllable work-hardening, Grain Size No. 11.

Dynapak, industry's first operational high-energy-rate machine tool, offers a breakthrough in metalworking's long-sought goal to produce forgings that can be used with little or no machining. This flange is just one of many forgings now being produced commercially by Dynapak. For complete information regarding application of pneumatically-energized Dynapak in your forging, extrusion, forming, or compaction operations, write, wire, or phone:

DYNAPAK

CONVAIR / A DIVISION OF GENERAL DYNAMICS CORPORATION

1243 Transit Avenue, Pomona, California • Telephone: NAtional 3-1561

TOOLS of today

Projector for Machine Tools

Designed for attachment to a variety of machine tools, a portable optical projector allows continuous precise magnified checking, direct measurement and comparison of work contours with transparent overlay charts.

Accessories include standard interchangeable magnifications of 10X, 20X, 31.25X, protractor screen, illuminators, and mounting compounds for direct linear measurement to 0.001 or 0.0001 in.

Conventional applications include circular and flat form tool grinding, production grinding of precision contours, regrinding of tools, and dressing of critical wheel and tool shapes. Applications for precision locating of printed circuit points, monitoring of extruded wire insulation, glass blowing contours, coil winding, metalizing and many miniaturization problems are solved by use of the projector.

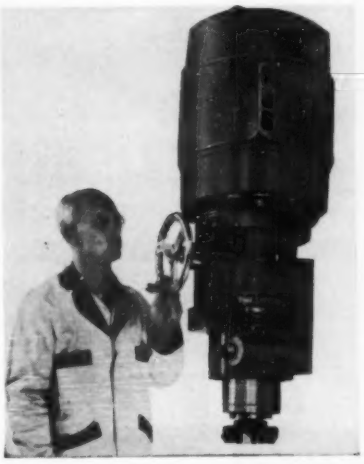
A complete accessory system allows adaption to many specific applications. The complete setup consists of both horizontal and vertical optical systems, a variety of interchangeable lenses, illuminators for contour (shadow) and/or surface (reflection) projection, power supply, 6-in. diamond ground glass screen with fresnel field lens, and compound mountings to provide focus adjustment and linear measurement in three planes.

Stocker and Yale, Inc., 40 Green St., Marblehead, Mass. **Circle 350**

USE READER SERVICE CARD ON PAGE 171 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Planer Conversion

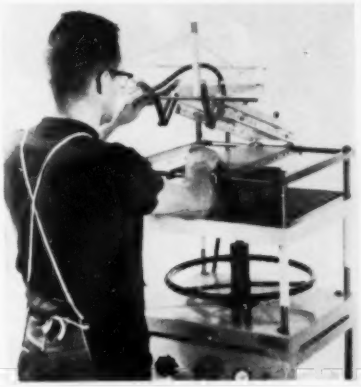
Slow or underpowered planers can be converted to modern planer-mills with the Veet Speedmiller head. This two-speed unit is rated at 30 hp, 900 rpm and 15 hp, 450 rpm. The machine changes required are essentially providing milling feed rates for the table and motorizing the cross rail.



Veet Industries, 25753 Groesbeck Hwy., E. Detroit, Mich. **Circle 351**

Plastic Press

Three-dimensional forming operations in thermoplastic sheet materials up to 18 in. sq, using the principles of mechanical stretch, vacuum and blow forming, can be accomplished with this plastic press.



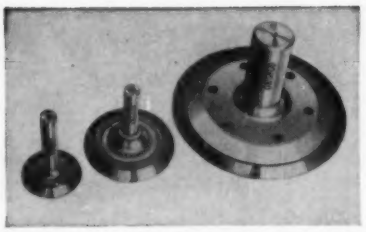
Changing from one forming method to another on the Di-Acro Model 18A is done by switching a central control. Separate vacuum gage, pressure gage and pressure regulator provide complete operator control.

The hinged clamp frame is adjustable for all thicknesses of thermoplastic sheet through ¼ in. Cross spacers permit clamping of sheets in 6, 9, 12 and 18-in. widths. Lengthwise adjustment ranges from 4 to 18 in. in increments of 1 in.

O'Neil-Irwin Mfg. Co., 625 Eighth Ave., Lake City, Minn. **Circle 352**

Milling Cutter for Honeycomb

Used for machining stainless-steel honeycomb core, these circular milling cutters are of the replaceable-ring type. A solid carbide ring is mechanically fastened to the cutter body. Design of the tool allows maximum resharpening of the ring before replacement. Stellite

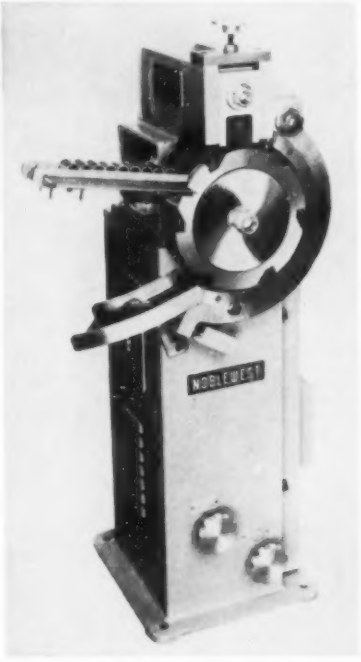


and high-speed steel rings may be substituted. The cutters are available in 1 to 8-in. diam.

Onsrud Cutter Mfg. Co., Inc., 800 E. Broadway, Libertyville, Ill. **Circle 353**

Roll Forming, Marking Machine

Model 523 rolls an angular groove around tubular parts as well as marking the manufacturer's identification and part number at a speed of 5000 parts per hour. The machine utilizes a single roll forming die, without the use of internal support or a female die and without distortion of the completed piece.



A work dial assembly rotates continuously in a clockwise direction, picking up the work from an inclined gravity feed chute and carrying it through the marking station. The part is carried through a segmental 17-in. circular grooving tool driven by a pressure roll, and rotated between the roll and the concave grooving tool. The part is ejected at the bottom of the work dial. An eccentric stud allows proper positioning for various diameters and depth of groove.

The Noble & Westbrook Mfg. Co., East Hartford, Conn. **Circle 354**

USE READER SERVICE CARD ON PAGE 171 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

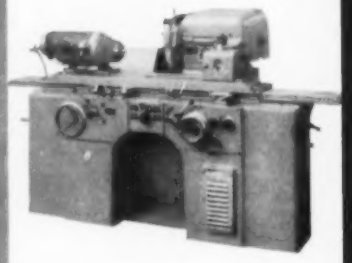
Lightweight Gear Motors

Lightweight models in ratings from ⅛ to ¾ hp are included in a line of right-angle integral type designs with output speeds, respectively, of 197 down to 6 rpm, and 780 to 13.5 rpm.

General Electric Co., Schenectady 5, N. Y. **Circle 355**

olivetti

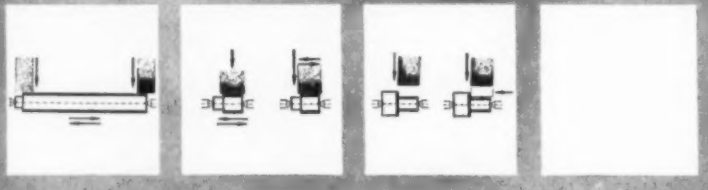
high-precision grinding machines with hydraulic automatic infeed for traverse grinding and plunge grinding



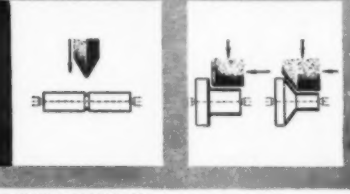
UNIVERSAL. *Swivelling wheelhead, swing-down internal grinding attachment, infinitely variable speed headstock.*

PRODUCTION. *Larger grinding wheel, more horsepower, non-swivelling wheelhead, 8-speed headstock.*

Model R4-500 U shown at left. Universal type, 10" swing, 24" center distance.



- *Infinitely variable hydraulically controlled table speeds*
- *Table reversals within ± .0002" as short as 1/16"*
- *Table dwell 0 to 20 seconds*
- *Automatic precision infeed to .000050", right, left or both ends of traverse*
- *Thumb jog for taking .0001" cuts on diameter*
- *Separate automatic plunge feed 0 to .002"/second to positive stop*



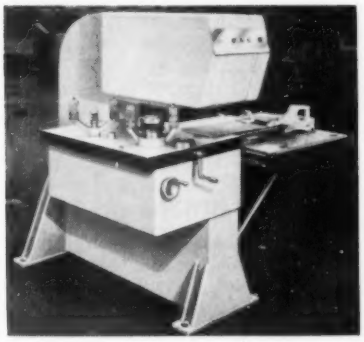
write Olivetti Corporation of America, 42-33 Northern Boulevard, Long Island City 1, New York Or phone RAvenswood 1-7575.

USE READER SERVICE CARD, CIRCLE 60

Punch Press

Single station, high-speed punch press has a throat capacity of 30 in. For straight-line punching, it will handle a 30-in. workpiece of any length, using a multiple stop gaging system. For production punching with a duplicator, the maximum work size is 25 x 30 in. Hole punching capacity ranges from a 3½-in. hole in 16 gauge mild steel to a ½-in. hole in ¼-in. mild steel with a tolerance of ±0.005 in.

The Super 30 Fabricator press will also handle 90-deg. corner notching up to 5 x 5 in. in 16 gage mild steel as well as rectangular, radii, "V" and specially shaped edge notches. Straight-line nibbling and contour shearing can be done at 165 fpm with a capacity of ⅛-in. mild steel. A single switch permits instant change-over from single stroke punching to nibbling.



A quick-change punch and die system enables the operator to change from one size to another in less than 20 seconds.

A duplicator can be built into the machine, utilizing a template for production-run punching. With the addition of another accessory, the duplicator can also be used to make templates from drawings, layouts or sample parts.

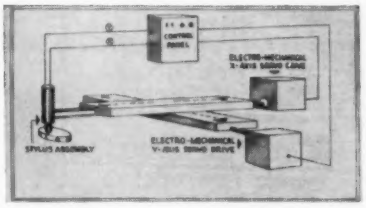
Wales-Strippit, Inc., 211 S. Buell Rd., Akron, N. Y. **Circle 356**

Tracer System

An electromechanically controlled two-dimension tracer system will follow and contour around a 360-deg. path at a constant speed, regardless of direction. Value of the speed can be varied manually or can be automatically controlled as a function of spindle speed, maintaining a constant feed rate.

Electromechanical design simplifies the tracer mechanism, reducing initial cost, standard maintenance and repair requirements.

The system can be easily adapted to either computer or punched tape control. Major features include a stylus which can approach the template at any angle, automatically switching to trace operation when contact is made. The system automatically compensates for tool wear by varying eccentricity of the stylus. The stylus assembly servo motor permits remote manual control at the table, provides constant bias torque for automatic operations, and permits



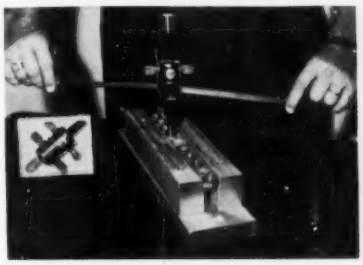
automatic control by tape or card for contouring without a template. The system will produce oversize template duplicates in controlled steps, facilitating removal of material that cannot be taken off in one pass.

Seneca Falls Machine Co., 20 Fyfe Bldg., Seneca Falls, N. Y. **Circle 357**

USE READER SERVICE CARD ON PAGE 171 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

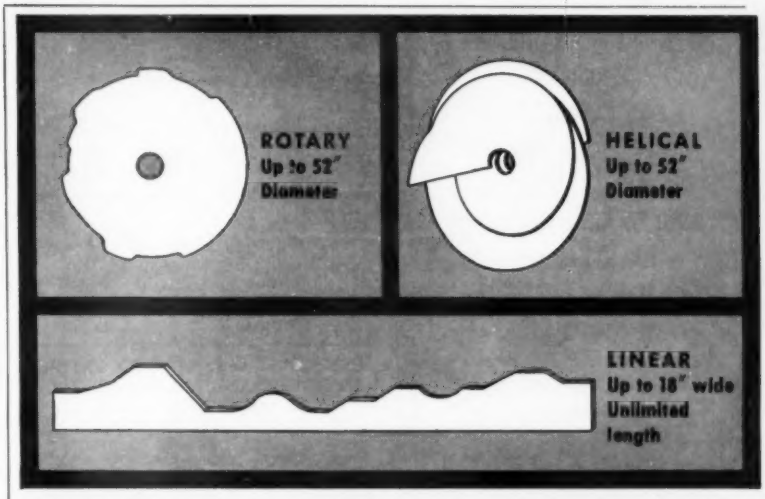
Gage Handle

Illustrated in use on parts contained in a specially designed holding fixture, this gage handle speeds up manual gaging of tapped holes from 100 to 900 percent without sacrificing operator "feel" and speed control. Hand pressure is eliminated while the gage is in motion, and sideward or downward pressure is minimized. The weight of the handle and gage is suspended between tapes. Parts may be gaged in any position. Bottom tabs are pulled to start gaging and top tabs reverse gaging.



A bristle brush has been adapted to the handle for cleaning tapped holes prior to gaging. Standard taperlock and reversible adapters are available.

C. E. Foster Gage Corp., 5341 English Ave., Indianapolis 19, Ind. **Circle 358**



TEMPLATES • CAMS • PROFILED PARTS

produced economically to your specifications

Produced on a special numerically-controlled, precision machine which makes it possible to produce parts in large or small quantities and to guarantee extreme accuracy ...If you require engineering, our staff of competent engineers is at your service.

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● ACTUAL MANUFACTURERS OF RESINOID METAL AND VITRIFIED DIAMOND WHEELS UP TO AND INCLUDING 24" DIAMETERS

Call or write for literature today!

THE PAUL L. KUZMICK COMPANY
271-279 GROVE AVE.
VERONA, N.J.

● MANUFACTURERS OF RESINOID AND RUBBER BONDED WHEELS SERVING THE AIRCRAFT, CUTLERY AND STEEL FABRICATING INDUSTRIES.

Call or write for literature today

PEKAY ABRASIVES, INC.
271 GROVE AVE.
VERONA, N.J.

USE READER SERVICE CARD, CIRCLE 62

OBI Press

Constructed of three basic modules —frame, drive and head—this Torc-Pac eccentric shaft drive press is easily maintained. Each module can be removed and replaced as a unit. The 60 ton press has an air-friction clutch with

bronze friction plates operating in a sealed-in-oil enclosure. Oils absorb the shock of the "pickup" load during engagement, cutting down wear on clutch and brake.

Clearing Div., U. S. Industries, Inc., 6499 W. 65th St., Chicago 38, Ill. **Circle 359**

USE READER SERVICE CARD ON PAGE 171 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Grinding Wheel Dressers

The "economy" line of dressers increase grinding efficiency by lowering grinding heat at area of contact. Small elongated diamonds are mounted in a steel matrix. The shape and mounting of the diamond keep the dresser sharp. The dressers are similar to throwaway tools in that they never require resetting. The same contact area of diamond is presented to the grinding wheel throughout the life of the tool.

Precision Diamond Tool Co., P. O. Box 274, Elgin, Ill. **Circle 360**

Jig and Fixture Materials

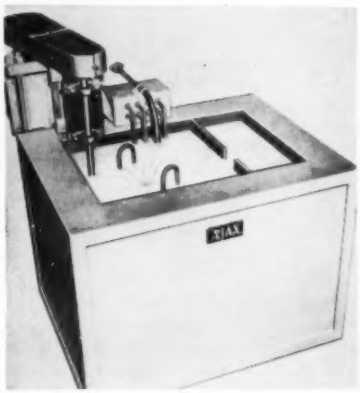
Standard Micron cast-iron shapes, including U's, T's, H's, hollow squares, rectangles and flat plates, provide for the economical building of small jigs and fixtures. They are cast in a range of sizes from 3 to 8 in. and in lengths of 25 in. which are cut to order.

The shapes are made of high-tensile-strength cast iron with all outside surfaces machined square and parallel within 0.005 in. per foot.

Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich. **Circle 361**

Quench Furnace

Salt bath Cataract Quench furnace offers any needed quench flow velocity. A temperature of 750 deg gives good results with no fire hazards involved. The quench proivdes uniform hardness, the elimination of cracks and negligible distortion. Circulation of the molten salt is concentrated in the work area of the bath.

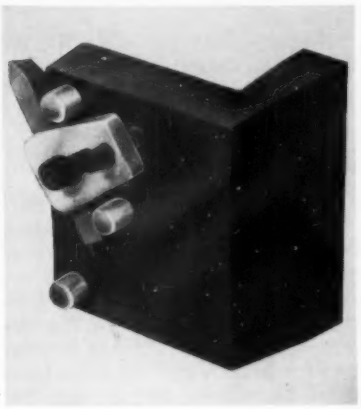


A cylinder-like header inserted in the working center of the quench chamber is connected at the bottom to a variable speed pump. An automatic system carries off any salt carried into the quench from a molten salt heating bath.

Ajax Electric Co., Frankford and Delaware Ave., Philadelphia 23, Pa. **Circle 362**

Grinding Fixture

Fixture for grinding threading tools requires no setting or adjustment and eliminates poor thread form and improper clearance angle. A 60-deg. nose angle and 7-deg. relief angle are incorporated in the fixture.



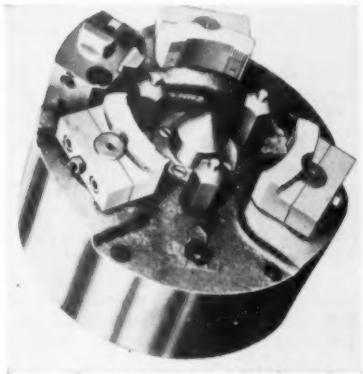
The fixture is 2 x 2¾ x 3⅝ in. and can be used to grind tools up to ¾ x ¾ in.

Cavic Engineering Co., 1313 W. Essex Ave., Kirkwood 22 ,Mo.

Circle 363

Power Chuck

Power chuck has ball joint actuation instead of the conventional T-slot design. The actuation provides pull back action against fixed work stops, resulting in greater accuracy and rigidity in chucking parts.

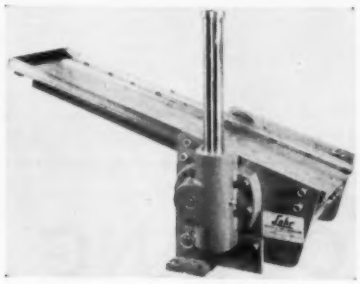


The Ball-Lok is primarily a single purpose chuck for use on multispindle turning or boring operations. Models are available for both external and internal application in standard sizes of 10, 12, 15 and 18-in.

N. A. Woodworth Co., 1300 E. 9 Mile Rd., Detroit 20, Mich. **Circle 364**

Reciprocating Unloader

Variable stroke reciprocating unloaders, controlled by movement of the press ram, remove parts and blanks from mechanical presses. The tray slides underneath the die during upstroke and receives the part or blank. During the downstroke of the press, the tray emerges with the part and the part slides off the tray and into a bin or onto a conveyor.



The rack-driven model has a full tray cycle actuated by a rack mounted to the press ram. In the cable-driven model, the tray instroke is powered by a steel cable attached to the press ram and the outstroke is powered by an air cylinder. Change gears are available to vary the tray stroke from 10 to 20 in. on small models with up to 36-in. trays, and from 12 to 30 in. on models with up to 72 in.-trays.

Lahr Machine & Tool Co., 3404 Maplewood Ave., Toledo ,Ohio.

Circle 365

USE READER SERVICE CARD ON PAGE 171 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

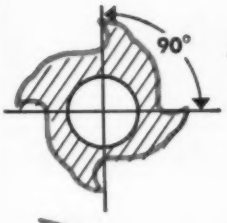
Eclipse **END MILLS**

OF

ADVANCED DESIGN

(AT NO EXTRA COST)

EXCLUSIVELY FEATURE



ACCURATE FLUTE INDEX

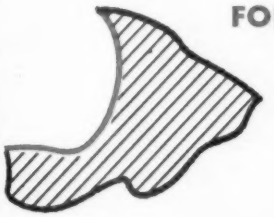
plus constant helix producing end mills having balanced cutting power which permits INCREASED RATE OF FEEDS

•

FORM RELIEVED LANDS

providing a strengthened keen cutting edge which means LONGER TOOL LIFE

•



FORM CUTTING FACE (HOOK)

permitting chips to flow freely reducing heat in cut which means FINE SMOOTH FINISHES

•

Write for Eclipse Catalog E 58 M

Economize With Eclipse

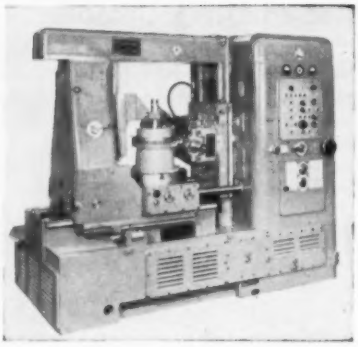
ECLIPSE COUNTERBORE COMPANY

END MILL DIVISION DETROIT 20, MICH.

USE READER SERVICE CARD, CIRCLE 63

Hobbing Machine

U. S. modification of the German Lorenz "F" series hobbers, a line of four basic models combines high versatility needed for job-lot hobbing with the high output capacity of mass-production type machines. Modifications include the use of U. S. motor drives and controls. All settings and dials are to U. S. measure.



Hob spindle speeds are variable from 20 to 40 rpm. Axial and radial feeds are also variable. The machines can be operated as automatic single-cut or as two-cut hobbers. Continuous hob-shifting (diagonal hobbing) or automatic increment hob-shifting methods are available. Various models in the line are for maximum gear diam of 10, 16 and 24 in.

Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich. **Circle 366**

SMART TOOLING

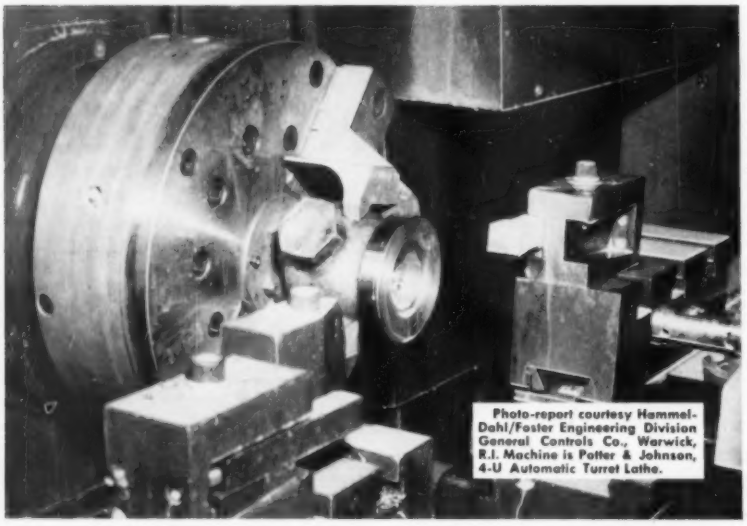


Photo-report courtesy Hammel-Dahl/Foster Engineering Division General Controls Co., Warwick, R.I. Machine is Potter & Johnson, 4-U Automatic Turret Lathe.

Jumps production 8 to 40 pieces per day with *Buck* 15" Aluminum power chuck

The round valve body was hard to hold on a turret lathe with a 4-jaw chuck—and truing each piece took too much time and labor. Production was 1 piece per hour, only 8 a day.

Then a Buck 15" 2-jaw aluminum power chuck was called on for Operation No. 1: face, turn, bore, counterbore, chamfer, and tap. The result—"Production is now 40 pieces per day . . . further savings would show if figures had been kept on breakdown time and chuck repairs formerly needed."

Concentricity is held to within .002"—accuracy that's possible due to the unique Buck Ajust-Tru® principle.

You can't raise production 500% every time—but you can make money every time you chuck with Buck. Send for a catalog—see why.

Makers of Scroll, Power, Dust Proof, Independent Chucks.

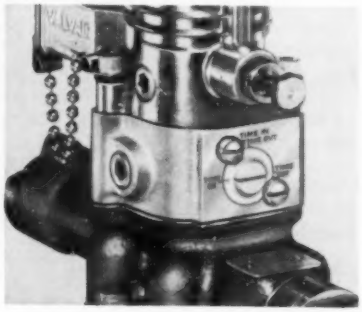
BUCK TOOL COMPANY

1133 SCHIPPERS LANE • KALAMAZOO, MICH.

USE READER SERVICE CARD, CIRCLE 64

Timing Sequence Head For Air Valves

A universal timing sequence head, for use on Speed King and Inline valves to eliminate timers and relays in circuits requiring time delay in valve function, is designed to time in, time out or time in and out. Delay in function from 0 to 30 sec is provided by the head. It can be extended up to several minutes by connecting an accessory reservoir to the port provided in the head. An accessible threaded metering pin in the side of the head sets the delay interval. Reliability is within two percent.



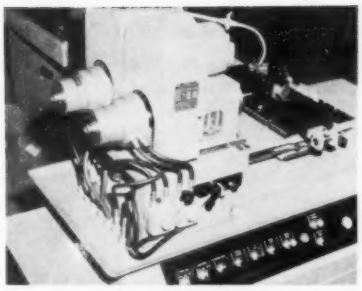
The head is available in two types, one for direct mounting between the pilot and valve body; the other for direct mounting on the valve body, but with remote pilot control. The head adds 1¼ in. to the over-all height of the valve assembly.

Valvair Corp., 454 Morgan Ave., Akron 11, Ohio. **Circle 367**

USE READER SERVICE CARD ON PAGE 171 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Collet Actuator

Illustrated mounted on a small precision boring machine, the Model 3A collet actuator provides uniform controlled holding pressure when machining or grinding precision parts. A flow control valve prevents drawback of the



work when the collet is closing. The hollow tube permits work, tools or coolant to be passed through the spindle.

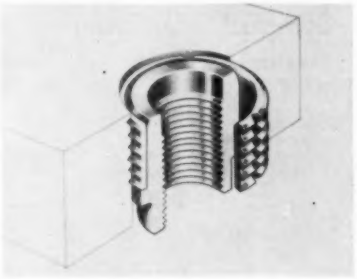
The nonrotating air cylinder may also be used to operate step chucks and expanding mandrels on lathes, grinders and boring machines. The actuator mounts directly on the spindle and does not require an adapter plate. Vibration is minimum, since only the adapters and inner races of the bearings rotate.

Powergrip, Inc., Rockfall, Conn. **Circle 368**

USE READER SERVICE CARD ON PAGE 171 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Threaded Insert

Hole preparation time is saved by the S110 insert, since its application requires only hole drilling, without counterboring and tapping. It can be used in open or blind applications, providing load bearing ,wear resistant, self-locking threads for holes in materials such as plate or cast aluminum and magnesium.



The insert consists of an internally threaded stainless-steel expander and an externally grooved alloy steel sleeve. The sleeve is prepositioned in the work hole and the expander is pulled into the sleeve. This results in an interference fit between the two pieces, swells the sleeve and forces the external grooves into the sides of the hole.

Six thread sizes ranging from 6-32NC-3B to 3/8-24UNF-3B are available.

Hi-Shear Rivet Tool Co., 2600 W. 247th St., Torrance, Calif. **Circle 369**

Open-Top Dryer

Available in steam or gas-heated models, the Blakeslee open-top dryer is designed for drying plated parts on racks after rinsing. A recirculating hot air system controls loss of heat and air. Small nozzles, placed at close intervals on the side of the drying chamber, direct air flow. A sliding damper regulates flow of secondary air.

The Biddle Co., 108 E. Market St., Bloomington, Ill. **Circle 370**

Air Drills

Weighing about 1½ lb. these ¼-in. air drills have a wide variety of applications. Drills are available in five speeds ranging from 500 to 4500 rpm at 90 psi air pressure. Chuck runout is less than paper thickness.

Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y. **Circle 371**

MAKE "IMPOSSIBLE" HOLES POSSIBLE . . .

With Lift Swing Drilling Fixtures

Use the Lift Swing Drilling Fixture with a double top plate and drill two holes side by side with a minimum of wall thickness in between . . . this is accomplished without "special" drill jig bushings and without difficult-to-grind flats on bushings . . . just drill using one side of the double plate, swing 180° and drill using the other side—fast and simple.

You can drill and ream or you can drill two different diameter holes at the same location; yes, two operations without bushing changes. Lift Swing with a double top plate . . . provides Faster, Easier Tooling; Reduced Tooling Costs; Less Down Time; Increased Production.

Accurate Lift Swing Drilling Fixtures come in either single or double "Swing Away" Top Plate models—and in a range of sizes to fit every need.

Investigate the real production cost savings Accurate Lift Swing Drilling Fixtures can bring you . . .

ABC

Write for Lift Swing Tooling Suggestions. Bulletin LS-58

ACCURATE BUSHING CO.

ASA Standard Drill Bushings • Precision Parts • Lift-Swing Drilling Fixtures

443 NORTH AVE., GARWOOD, N. J.

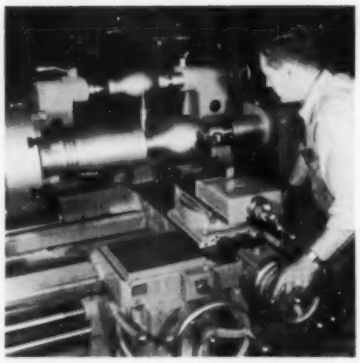
USE READER SERVICE CARD, CIRCLE 65

Hydraulic Tracer

Ninety-deg tracer, suited for turning stepped shafts, spindles, gear blanks, forming rolls, arbors, axles, cones, sheves, pistons and balls, will trace from either flat or full round templates.

A master workpiece can be used for a template or a flat template can be cut from flat stock. The template is mounted between centers behind the workpiece and the tracing stylus contacts it from below.

When the tracer is operating, the cross-slide screw is locked out and motion is transmitted directly from the tracer cylinder to tool turret by a solid steel bar.



Sizes are available for 16, 20, 25, 32 and 40-in. standard duty lathes and 13, 16, 20, 25 and 32-in. heavy-duty machines.

R. K. LeBlond Machine Tool Co., Cincinnati, Ohio. **Circle 372**

Honing Machine

Honing machine designed for production runs, toolroom work and salvage operations, provides spindle speeds of from 225 to 525 rpm, or an optional range of 450 to 1050 rpm.

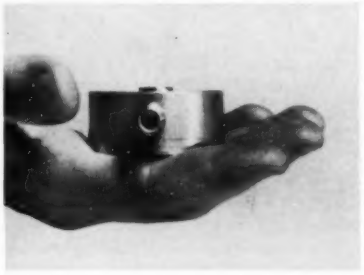
Optional equipment for the Model J2 includes a dial indicator, full width extension tray and filter tray with three settling baffles and burlap filter.

Superior Hone Corp., 1612 Elreno St., Elkhart, Ind. **Circle 373**

USE READER SERVICE CARD ON PAGE 171 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Compact Air Cylinders

Developed principally for the tooling industry, a "Pancake Line" of three



sizes of push type air cylinder is available in pressure ratios ranging from 1:1 (line pressure) to three times line pressure and with strokes of from 0.001 to 1 in.

Fabco, 1231 Main Ave., Cleveland 13, Ohio. **Circle 374**

MANEX OPTICAL JIG BORER

AND

***JIG GRINDER**

$7650.00
F.O.B. Docks N.Y.

All Castings are made of Meehanite
All Gears are Hardened and Ground

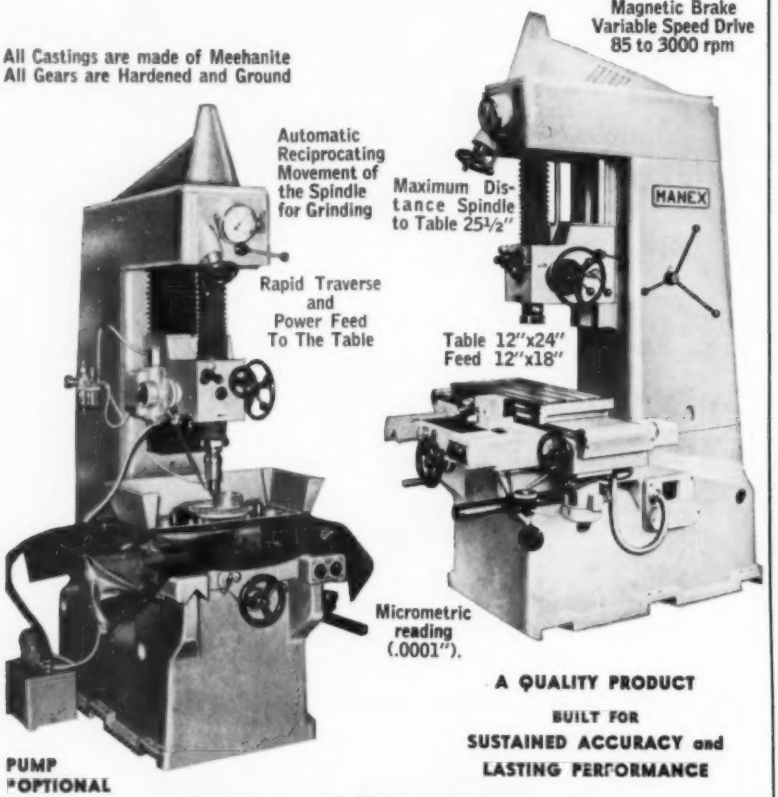
Magnetic Brake
Variable Speed Drive
85 to 3000 rpm

Automatic Reciprocating Movement of the Spindle for Grinding

Maximum Distance Spindle to Table 25½"

Rapid Traverse and Power Feed To The Table

Table 12"x24"
Feed 12"x18"



Micrometric reading (.0001").

PUMP
*OPTIONAL

A QUALITY PRODUCT
BUILT FOR
SUSTAINED ACCURACY and
LASTING PERFORMANCE

MANEX MACHINERY CORPORATION

204 Central Park South — New York, N. Y.

Telephone: Circle 6-5277
USE READER SERVICE CARD, CIRCLE 66

Plastic Coating

Fusing to form a rigid hard solid, Denflex Plastisol No. 9218 is applicable for rotational and slush molding and for hot dip coating of metal parts. The product has high dimensional stability, low lacquer mar, high tensile strength, good dielectric properties and high impact resistance. Present uses include coatings for tool handles, slush-molded rigid display form, rotationally cast toys and novelties, and cast chemically resistant parts.

Dennis Chemical Co., 2701 Papin St., St. Louis, Mo. **Circle 375**

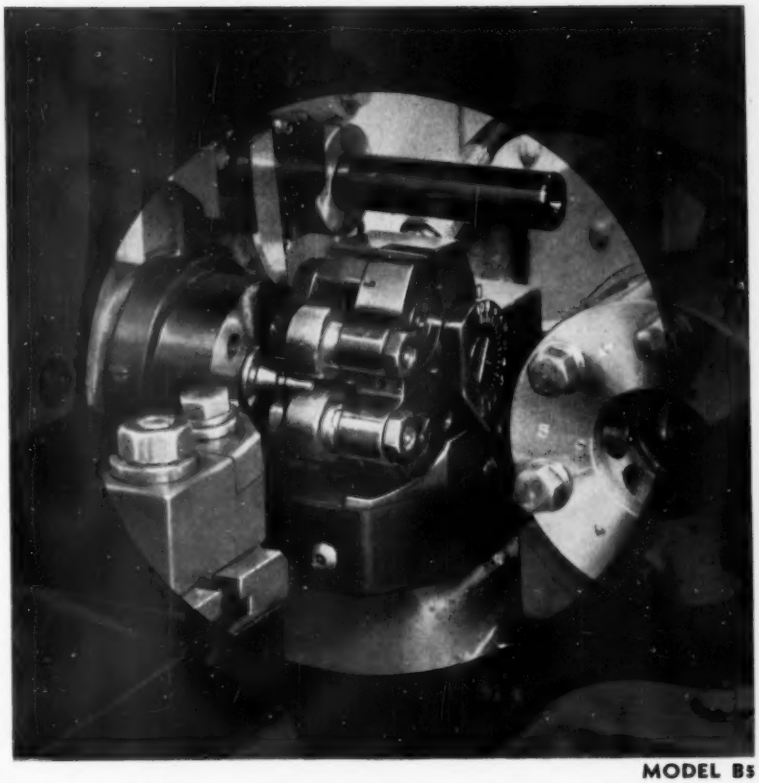
USE READER SERVICE CARD ON PAGE 171 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Drill Point Grinder

Conventional formed or split points can be ground on a high-precision, high-production basis with this drill point grinder. Time studies show that the average operator can grind over 450 No. 40 drills (0.098) per hour with the unit.

A V-rest drill holder securely holds and positions each drill for grinding, eliminating the need for loading or adjustment of bushings, jaws or collets. A calibrated swivel fixture grinds conventional points with included angles of 118 to 150 deg. The unit provides for pointing of all drill sizes from 1/16 to 1/2-in. diam and up to six in. in length. Additional fixtures are available for angles less than 118 deg and for extending the drill-length range to 12 in. Attachments are available for split-pointing and helicentric pointing.

Morse Twist Drill and Machine Co., New Bedford, Mass. **Circle 376**



MODEL B5

New Thread Rolling Attachment for # 00 *Brown & Sharpe*

- *Reduces Pressure on Spindle*
- *Produces Higher Quality Threads on steel, brass and aluminum*
- *Increases Threading Capabilities*
- *Eliminates Secondary Operations by Threading Behind Shoulders*
- *Threads Rolled Close to Collet*
- *Reduces Inspection Costs*

With this latest Reed Attachment the threading capacity of your #00 Brown & Sharpe can be greatly increased. The attachment has a diameter capacity of up to 3/16 inch and maximum thread length of 1/2 inch. It is easy to set up and operate and precision adjustments assure accurate matching and positioning.

REED RTD TRA-174

REED ROLLED THREAD DIE CO.

Specialists in Thread and Form Rolling Tools and Equipment

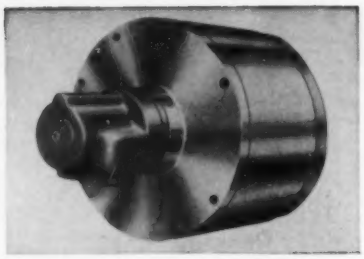
HOLDEN, MASSACHUSETTS, U. S. A.

Sales Offices in: Buffalo, Chicago, Cleveland, Compton, Calif., Denver, Detroit, Englewood, N. J., Houston, Indianapolis, Milwaukee, Montreal, New York City, Phila., Pittsburgh, St. Louis, Syracuse, Toronto

USE READER SERVICE CARD, CIRCLE 67

Rotating Air Cylinder

To provide high spindle speeds on metalworking machines, Model RM rotating air cylinder provides speeds up to 3600 rpm to actuate chucks, collets and other rotating holding devices. The low weight of the cylinder and its lessened flywheel effect reduce the load on the machine's components, cutting operation and maintenance costs. Three

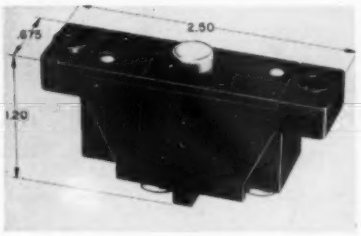


to 16-in. bore sizes are available.

The S-P Mfg. Corp., 30201 Aurora Rd., Solon, Ohio **Circle 377**

Limit Switches

A series of 2-circuit switches is designed for use on machine tool limit and control mechanisms. Median mechanical life is over 10 million operations at full overtravel. Three switches have a combined stacking width of 2.03 in. A step-design, arc-resistant plastic case provides extra space between the integral terminals, reducing the possibility of shorting.



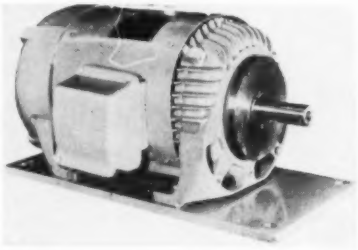
Contact arrangement is single-pole tow-circuit double-break. Underwriters' Laboratories listing: 15 amps, 120, 240, 480 or 600 vac.

Micro Switch Div., Minneapolis-Honeywell Regulator Co., Freeport, Ill. **Circle 378**

USE READER SERVICE CARD ON PAGE 171 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

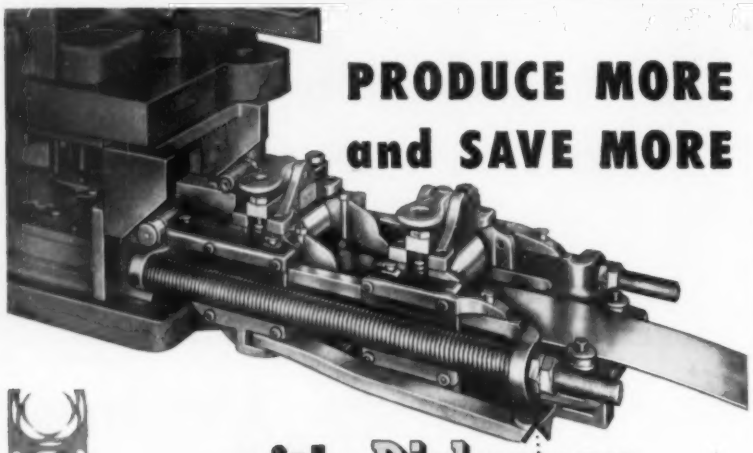
Wheelhead Motor

Precision wheelhead motor for grinding wheel applications is made in frames 213 through the 256-U, totally enclosed fan-cooled type. The motor is constructed to isolate 120-cycle vibration thus eliminating a cause of blemishes on ground surfaces. Standard NEMA mounting dimensions are used.



The rotor is balanced to 0.0001 in. An external means is provided for balancing the rotor to eliminate disassembly for final balancing. The maximum shaft runout is held to 0.00025 in.

Westinghouse Electric Corp., P. O. Box 2099 Pittsburgh, Pa. **Circle 379**



PRODUCE MORE and SAVE MORE

...with Dickerman PRESS FEEDS!

"STANDARD" DICKERMAN DIE FEED

80 strokes per minute on .030" cold rolled steel 3" wide with Dickerman 6 x 4 Die Feed.

45 strokes per minute on .030" cold rolled steel 4¼" wide with Dickerman 6 x 6 Die Feed.

Rugged, dependability built into every one of the 14 standard off-the-shelf feeds give 24 hour a day trouble-free performance.
At any speed the tooling will withstand, where high precision or high production are required, Dickerman Feeds pay for themselves and then go on paying dividends over and over again. Many Dickerman feeds have performed flawlessly for over 100 million strokes.

Improve your press feeding profits —send for the Dickerman "Standard" Catalog File and prices today!

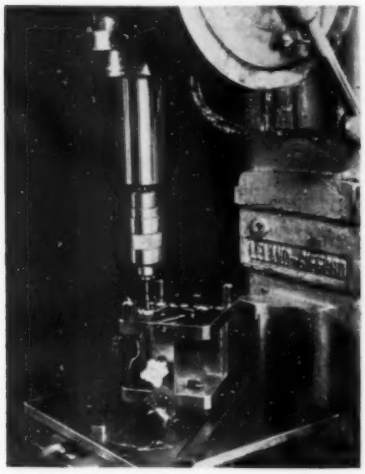
Dickerman

H. E. DICKERMAN MFG. CO.
321-333 Albany Street • Springfield, Mass.

USE READER SERVICE CARD, CIRCLE 68

Drill, Reamer Driver

Compact drill and reamer driver prevents breakage caused by dulling tools and improper operation of manual-feed machines. The torque-sensitive driver, for use in manual-feed drilling and

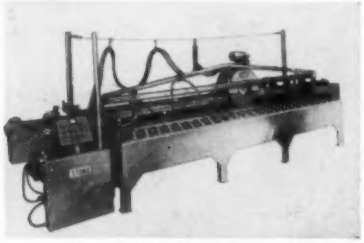


reaming operations, has an over-rolling type adjustable clutch to disengage the tool when breakage is eminent. It adapts to standard machine spindles and drill chucks and can be adjusted for a variety of jobs.

Scully-Jones and Co., 1901 S. Rockwell St., Chicago 8, Ill. **Circle 380**

Cutting Machine

Traverse type metal-cutting machine provides power raising and lowering of rails to quickly obtain correct wheel arc of contact for any thickness of plate or stock. Pushbutton control gives change-over in minimum time.



Automatic elevation facilitates positioning of new stock and removal of finished material. Air clamps exerting 535-lb pressure hold stock in position on a reinforced steel base. The 12-in. blade is powered by a 10-hp motor. Rate of cutting on 3-in. aluminum plate is 18 ipm.

Stone Machinery Co., Manlius, N. Y. **Circle 381**

Twist Drill

Chip breaker drill both breaks and controls size of chips, eliminates stringy chip hazards, retains positive rake at

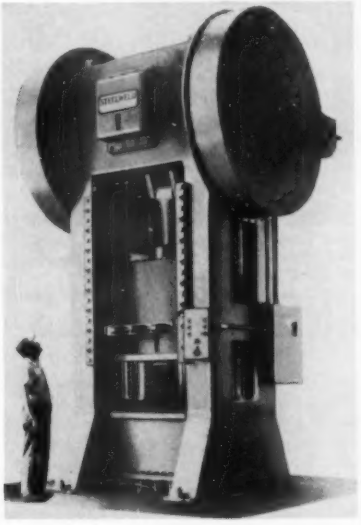
cutting lip, penetrates easily on heavy-duty jobs and permits continuous drilling. Lo-Tork drills are available in ¾-in. and larger sizes in taper shank and straight shank series.

Chicago-Latrobe, 411 W. Ontario St., Chicago 10, Ill. **Circle 382**

USE READER SERVICE CARD ON PAGE 171 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

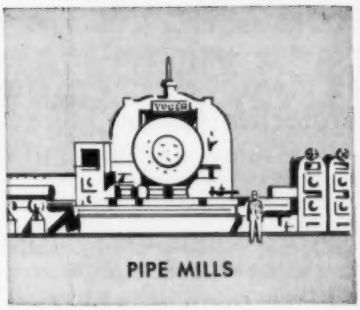
Speed-Draw Press

Particularly suited for deep-draw applications, this press permits making extra long draws at higher speeds than standard crank type presses. This greater speed is made possible by a toggle-eccentric mechanism that shortens



downstroke and upstroke times. Press is equally advantageous for standard press applications. Capacities of 200 ton and up are available. Mid-stroke capacity of machine is 50 percent of full load capacity.

Cleveland Crane & Engineering Co., Wickliff, Ohio. **Circle 383**



PIPE MILLS

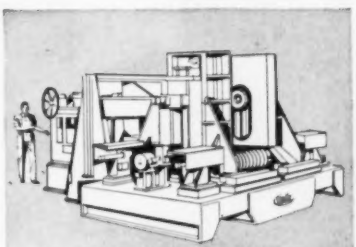
YODER
PIPE AND TUBE MILLS

Today's expanding markets and tightening economy demand closer production cost control. YODER'S complete line of ferrous or non-ferrous Pipe and Tube mills can help you meet production schedules economically... help you realize significant savings in the manufacture of tube and pipe.

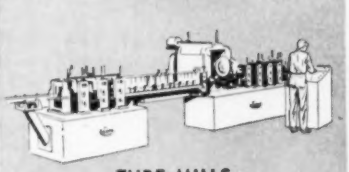
YODER Pipe and Tube mills offer flexible production to meet fluctuating demand. They adapt easily to the most rigorous schedules. Everyday manufacture of constant high quality pipe and tube in diameter of 5/16" to 24". Speeds up to 350 fpm plus can be obtained with YODER mills.

YODER also makes a complete line of Slitting equipment and Cold Roll-Forming machinery. Send for your copy of the fully-descriptive book covering Tube Mill operation.

THE YODER COMPANY
5525 Walworth Ave. • Cleveland 2, Ohio



HEAVY DUTY UNCOILERS



TUBE MILLS

ENGINEERING YODER MANUFACTURING
PIPE AND TUBE MILLS
(ferrous or non-ferrous)

USE READER SERVICE CARD, CIRCLE 69

Protective Coating

General-purpose, one-part neoprene rubber based coating provides chemical, abrasion and weathering resistance for the protection of metal, wood, concrete, cloth and polyester plastics. Called Coro-Gard 1760, it has high adhesion to unprimed steel, aluminum, copper, galvanized steel and other materials. The coating air-cures to a tough rubbery film, resistant to a 20 percent concentration of hydrochloric and sulfuric acids, distilled and salt water and alkalies, at continuous service temperatures up to 120 deg. The coating can be applied with a brush without diluting or stirring.

Adhesives and Coatings Div., Minnesota Mining and Mfg. Co., 900 Bush Ave., St. Paul 6, Minn. **Circle 384**

USE READER SERVICE CARD ON PAGE 171 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

ILLUSTRATED:
Speedgrip No. 3 Standard Straight Shank Mandrel, with hardened steel collet bushing.

SPEEDGRIP
EXPANDING MANDRELS

. . . are made from high grade alloy steel, heat treated; ground to precision gauges. Threads are ground after heat treating — assuring true perfection with the axis of the mandrel. Precision processing, combined with rigid inspection standards, give *Speedgrip* users maximum accuracy in their work parts. Many other advantages:

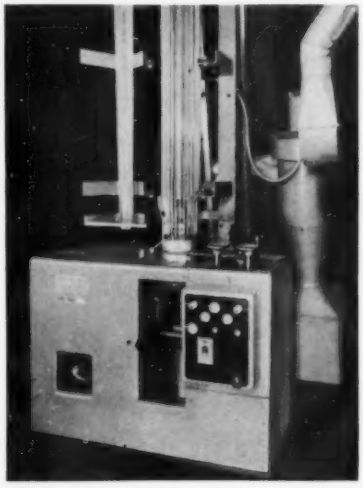
• Extremely simple design • Holds between centers or drives from taper shank • Holds diameters concentric and faces parallel within .0005 • Positions work parts longitudinally, quickly and accurately • Wide range of bore sizes accommodated by one mandrel • Safe and speedy operation • Full range of standard collet bushings available from stock • Modest price • Prompt shipment • Guaranteed

Write for complete information. Ask for bulletin 26.

SPEEDGRIP CHUCK Division of ERNEST, HOLDEMAN & COLLET, INC., Elkhart, Indiana
USE READER SERVICE CARD, CIRCLE 70

Vertical Cutoff Saw

A machine that cuts multiple types of tubings and solids in various shapes, has a maximum production rate that ranges from 100,000 pieces per hour on 3/16-in. diam. tubing to 25,000 pieces per hour on 1-in. diam. tubing.

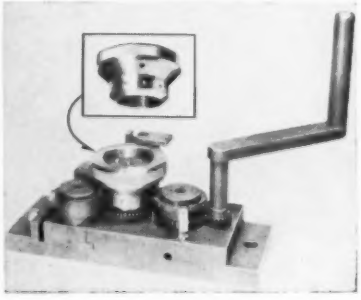


This vertical cutoff saw produces burr-free lengths of from 1/4 to 7 in. with close tolerances and handles material up to 20 ft. in length.

National Copper & Smelting Co., Cleveland 6, Ohio. **Circle 385**

Marking Fixture

Equally spaced numbers can be stamped around the circumference of metal parts with the Model GRD-950-1A marking fixture. The fixture has three main components: a circular marking



die, a workholding mandrel and a handle. These units are geared together to provide synchronized rotation of the part and the marking roll. Depth of impression can be adapted for graduation marking where extremely close tolerances are not required.

M. E. Cunningham Co., 1025 Chateau St., Pittsburgh 33, Pa. **Circle 386**

Drill Pointer

Model 100 Winslow-Matic drill pointer automatically and precisely produces helical (self-centering) and conventional points. Points are concentric within 0.0002 in. The machine will point drills from 0.032 through 1.50-in. diam.

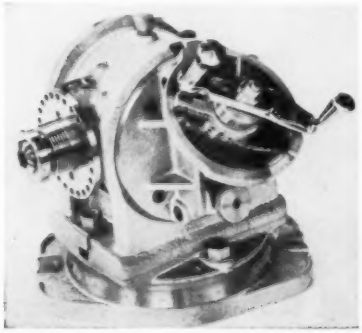
Four different power-operated work heads can be quickly changed to accommodate the diam range. Operation is on a continuous cycle. Forms are generated by a combination of two cam movements, the point is formed on a 20-in. diam cutting wheel, and drills are automatically rejected. Indexing is controlled at the point of drill, eliminating adjustment for variations in drill length.

Winslow Product Engineering Corp., 47 St. Joseph St., Arcadia, Calif.

Circle 387

Dividing Head

Ten-in. trunnion type universal dividing head has indexing accuracy of 1 min. in 360 deg; an optional auxiliary swivel base providing 360-deg swiveling in the longitudinal plane; compound, direct and crank indexing; and optional 2-in. riser blocks for headstock and tailstock.



Accessories available for the Model E include a draw-in attachment for No. 5C collets up to 1 1/16-in. capacity, chuck and face plates.

Nichols-Morris Corp., P. O. Box 430, White Plains, N. Y. **Circle 388**

USE READER SERVICE CARD ON PAGE 171 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Phosphating Compound

A phosphating compound which operates at a temperature as much as 75 deg lower than that required by conventional phosphating processes can be applied by immersion or spray washer. When applied at 95 deg, the compound provides a paint-gripping coating on iron, steel or zinc equal to those provided by phosphating processes requiring operating temperatures of up to 180 deg.

replaceable boring and reaming cutters

Save 70% or more in tool costs and production time on holes over 5/8"

• Diameter adjustable within 1/4 in. range: Blades are expandable *as they wear* for maximum tool life and accurate tolerance control. Grind blades for tolerance *only; not* for size.

• Blades replaceable: Madison slotted bars wear indefinitely. You replace blades only, with costs averaging 1/3 that of solid flute reamers. Down-time for replacement and adjustment is negligible.

• Cut tool inventory: *One* Madison slotted bar can be used on holes of *many* varied diameters . . . since each bar accommodates a broad range of cutter sizes.

• No alignment problem: Madison reamer blades *float* in the bar slot . . . are self-centering in the hole. No floating holders required, no compensation for spindle wear. (NOTE: *Boring* cutters are *fixed* in their slots . . . do *not* float.)

• Free cutting action, no chip pack-up: Generous chip clearance permits free circulation of coolant for higher speeds, finer finishes, closer tolerances.

• Multiple operations in one pass can be performed simply by spacing standard Madison blades on specially made bars. Any combination of reaming, boring, chamfering and other hole-making jobs can be completed on a *variety of diameters* . . . and in *one pass!*

Write for further information to:

MADISON *Industries* Dept. TR-11, Box 1137 Providence, R. I.

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As a bond for paint, the Turcoat Lo-Temp compound gives a uniformly smooth coating of up to 200 mg per sq ft in two min. at 95 deg. Applied as a base for corrosion prevention, the compound provides up to 1100 mg per sq ft coating in 10 to 15 min. at 95 deg.

Turco Products, Inc., 24600 S. Main St., Wilmington, Calif. **Circle 389**

Burring Tool

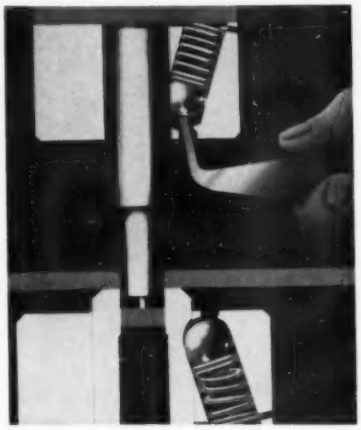
Line of burrs has a special Dia-Mo cut that provides three cutting edges. The three-sided tooth formation results from careful control of the depth of the

flute, both left and right, and a definite ratio between both flutes. Decrease in "burr climb" increases cutting action and stock removal and provides longer tool life. The design is particularly adaptable for burring heat-treated, alloy and stainless steels. Its shearing action produces a fine flake type chips. Recommended operating speed is ⅛ to ½ that of conventional burrs. The burrs are available in 615 sizes in standard, fine and coarse cuts.

The Antrax Co., 240 Day St., Newington 11, Conn. **Circle 390**

Slug-Shedder Punch

Designed to minimize slug pulling, the R-B slug-shedder punch has a high-speed steel body that contains a coil spring. The end of the spring extends 3/64 in. beyond the punch point. When piercing, the compressed spring pushes each slug away from the punch point, eliminating slug-pulling on the return stroke.



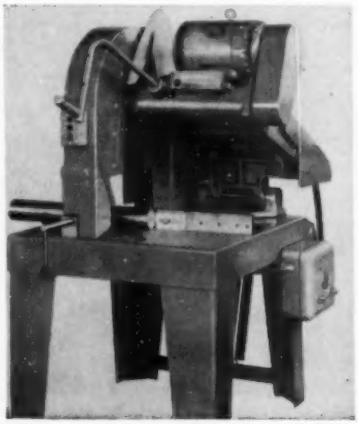
Punches are available with round punch points from 1/16 to 5/8-in. diam and punch lengths from 2 to 3 in.

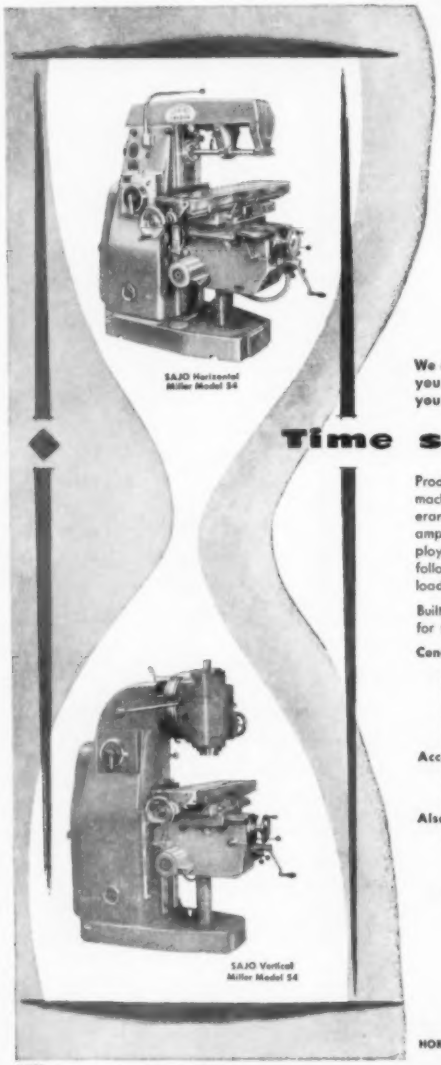
Richard Brothers Punch Div., Allied Products Corp., 26500 Capitol Ave., Detroit 39, Mich. **Circle 391**

USE READER SERVICE CARD ON PAGE 171 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Cutting Machine

Large capacity dry cutting machine is designed for heavy-duty work. Model 2-A Sever-All has the capacity to cut nearly all metals up to 4-in. solids, 5½-in. OD pipe or tube, 6 x 1-in. flat stock, 6-in. angle iron and 8-in. channel iron.





We can't turn back the calendar, but—
you can buy SAJO Millers today at the same price you paid for a comparable machine tool in 1949.

Time stood still...

Produced by Sweden's master craftsmen, these modern machine tools are engineered to maintain precise tolerances in continuous heavy-duty production. An example is the unique SAJO spindle construction employing SKF precision 2-row staggered roller bearings followed by thrust ball bearings, providing better load distribution and silent, vibration-free operation.

Built to U. S. standards, SAJO Millers are recognized for their accuracy, dependability and long life.

Condensed specifications:
table 52" x 11"
longitudinal movement 33½"
16 spindle speeds, 39-1500 r.p.m.
American Standard Taper No. 50
main drive motor 7½ h.p.
feed motor 1½ h.p.

Accessories:
Universal Dividing Head, Rotary Index Table, Vertical and Universal Milling Attachments, Slotting Attachment, Vises, Arbors.

Also available:
SAJO Plain and Universal Millers, table size 41½"x9¼".

Here are "hindsight" opportunities for foresighted machine tool buyers.

Write for literature and references in your area.

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Equipped with a 10-hp special high torque motor and utilizing a 20 x ⅛ x 1-in. abrasive cutting wheel, the machine's rate of cut is from 2 to 3 sec per sq in. of metal cut.

American Chain & Cable Co., Inc., 929 Connecticut Ave., Bridgeport 2, Conn. **Circle 392**

Grinding Tool

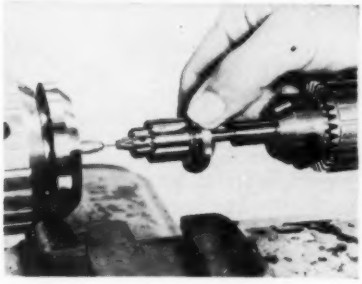
Flexible shaft hand grinding tool provides speeds of 500 to 3500 rpm at the geared end and 3000 to 15,000 rpm at the direct drive end of the 1/15-hp universal type motor. Speed is controlled through a foot-operated rheostat.

The 36-in.-long sheath is moisture, oil and grease resistant. The flexible shaft operates through a bronze liner. Geared chuck capacity is 0 to ⅛ in.

The Dumore Co., 1300 Seventeenth St., Racine, Wis. **Circle 393**

Hole Driller

Precision hole driller for mill or drill press is equipped with either an Albrecht micrometer chuck or a small

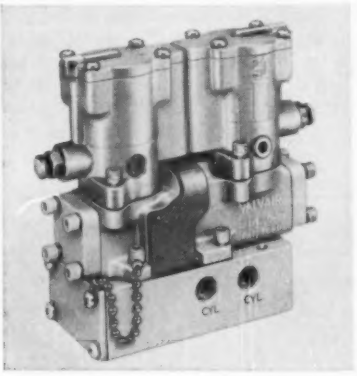


Jacob's chuck. The finger-tip control tool has an accuracy of 0.0002 in.

Hunter Tool, P. O. Box 564, Whittier, Calif. **Circle 394**

Control Valves

Plug-in type ¼-in. pilot-operated control valves have one-piece solenoid pilot housings and aluminum bodies and subbases. Built-in plugs and connectors in the Speed King pilot, valve body and subbase complete electrical connections as the body and pilot are bolted into place. All pneumatic or fluid connections are also made automatically. The design reduces installation and maintenance costs and machine down-time.



Designed for 30 to 200 psi service, the valves are available in single and double solenoid types, for subbase or multiple manifold mounting.

Valvair Corp., 454 Morgan Ave., Akron 11, Ohio. **Circle 395**

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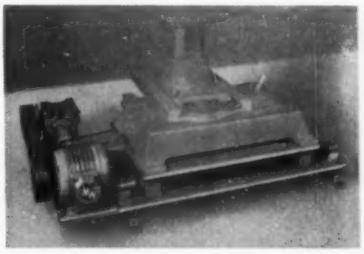
Oscillating Platform

Polishing and buffing heads which require oscillation can be mounted on this oscillating platform that is supported on heavy lateral bearing rails which hold the head in absolute align-



ment. The head is bolted to the platform. A cam-activated arm and a drive reducer move the entire head and its mounting back and forth smoothly. Units are available for nonoscillating heads weighing up to 3000 lb.

Murray-Way Corp., P.O. Box 180, Birmingham, Mich. **Circle 396**

SLOCOMB
MICROMETERS

Whatever your micrometer requirements, chances are Slocomb has it. Slocomb micrometers range from the 1" conventional micrometer calipers to 60" Rigitube models. Airfoil, tube, screw thread and sheet metal types . . . just to mention a few of the many available specials . . . as well as the new Slocomb Snap Gage micrometer, designed to eliminate a complete line of fixed snap gages.

All Slocomb micrometers have as standard optional features your choice of terminals . . . carbide, 60° points, ½" diameter discs, ball ends or rounded anvil.

SPEEDMIKE

Another Slocomb first! Digitally read, the new Speedmike achieves the ultimate in measuring speed and accuracy. Yes . . . you can have Speedmike's "direct reading" feature on other Slocomb micrometers.

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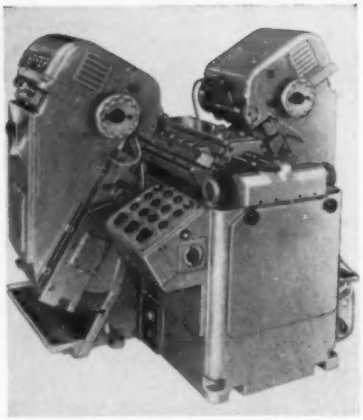
Standard Ejector Sleeves

Premachined ejector sleeves, available in four standard lengths, make it unnecessary for mold-makers to make their own ejector sleeves. Lengths are 4, 6, 8 and 10 in. with standard 2¾ in. bearing surfaces. These sleeves enable mold-makers to install standard ejector sleeves from ¼ to 1 1/16-in. OD in any length from 2 to 10 in., with a minimum ¾-in. bearing surface on the inside diameter. An almost unlimited combination of OD, ID and length dimensions can be obtained by cutting the standard sleeve to length and relieving the ID.

Detroit Mold Engineering, 6683 E. McNichols Rd., Detroit 12, Mich. **Circle 397**

Rack Cutters

Various cutting tools are available for both the 205 and 210 models of the Koepfer automatic rack cutters, which can be equipped with either one or two cutting heads. Capacities are limited only by the size of the cuts being made in the workpiece. Cutting, milling and feeds are automatically controlled through selector panel. Skip milling is done through a cam mechanism. Spindle speeds are adjustable from 80 to 645 rpm. Maximum cutting lengths are 20 in. on Model 205 and 40 in. on Model 210.



Cosa Corp., 405 Lexington Ave., New York, N. Y. **Circle 398**

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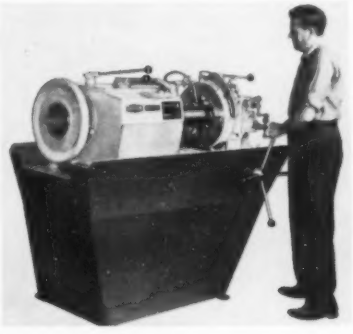
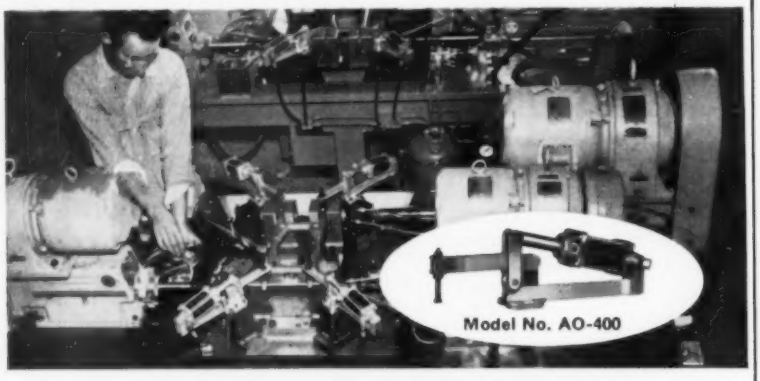
Pipe Machine

Pipe machine equipped with tangential type die heads and chasers has a standard range of one to four in. and an extra range of ½ to ¾-in. pipe.



Two quick-opening lever-operated die heads cover the entire range. The large head is mounted permanently on the machine and the second head, used for smaller diameter, is mounted on the face of the large head, eliminating constant head changing and providing size conversion in minimum time. The machine has four lever-controlled spindle speeds.

The Oster Mfg. Co., 1340 E. 289th St. Wickliff, Ohio. **Circle 399**



IF PARTS MUST BE HELD

LET KNU-VISE CLAMPS SUPPLY THE MUSCLES

Machining, welding, assembly—wherever parts must be securely held during a manufacturing process—that's where you'll find a lion's share of the work being done by versatile, air-operated Knu-Vise clamps.

Typical of the countless clamping applications handled so successfully throughout American industry by Knu-Vise clamps is the operation illustrated above—the holding of air frame components during drilling operations. These special machines were designed and built by Hewitt and Faust Mfg. Co., El Cajon, California.

If your company has a metal holding application that demands accurate, positive clamping you'll find Lapeer Mfg. Company has a Knu-Vise clamp that will meet your exact needs. Knu-Vise clamps are available in manual, air and oil operated models—are manufactured to give maintenance-free service year-in-and-year-out under the toughest operating conditions.

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Manufacturers of over 150 models of manually and air-operated clamps and pliers

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1131 Pettit Road, Burlington, Ontario

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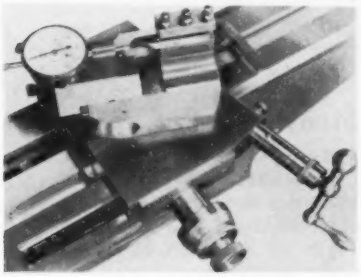
Radius Turning Attachment

Attachment will machine concave or convex surfaces on the axis of the lathe by generating the surface with a single-point turning tool. The tool bit is



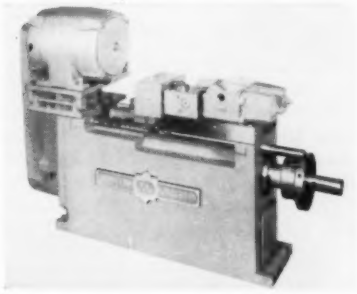
set directely to the desired radius by taking the reading on a dial indicator which reads in thousandths. Positive, even feed is controlled by a worm and worm gear.

Capacity is from 0 to 3⅝-in., concave or convex. The beveled edge reads directly in degrees.

Wade Tool Co., 49 River St., Waltham, Mass. **Circle 400**

Hydraulic Quill Unit

Adapted to building-block construction of machine tools, this self-contained quill type unit has standard hydraulic valves, pump and switches for power control of feeds. The unit can be used for single-spindle applications, or the front flange can be used for



mounting a multispindle head. Specifications include a stroke of from 0 to 8 in.; a theoretical thrust of 3500 lb at 750 psi; a feed rate of from 0.2 to 40 ipm at 500 psi; and a theoretical rapid approach and return rate of 240 ipm.

Rehnberg-Jacobson Mfg. Co., 2135 Kishwaukee St., Rockford, Ill. **Circle 401**

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ALLEN

The cost of ALLEN Hex-Socket Cap Screws is only a minor fraction of your assembly costs . . . be sure you're getting the timesaving, cost-saving advantages of genuine Allens!

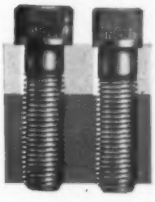
Ever since Allen first produced the hex socket head screw nearly fifty years ago, specifying *genuine* Allens (made by Allen of Hartford) has been a sure way to guarantee dependable threaded fastening.

Only *genuine* Allens have Leader Points that make starting easier, and greatly minimize danger of cross threading. *Genuine* Allens are "pressurformd" to preserve the long fibers uncut throughout the length of the screw, giving stronger sockets for greater tightening torque.

Write for samples and engineering data. See how *genuine* Allens will make your product better.

ALLEN HEAD HEX-SOCKET SCREWS

Allen's new 1960 Series Socket Head Cap Screws give up to 2½ times more load carrying capacity, without indentation. Head diameter of sizes from ¼" up is now uniformly 1½ times the body diameter—providing more under-the-head bearing surface, and a proportionate increase in clamping force. Write for new Bulletin G-25, with full specifications.



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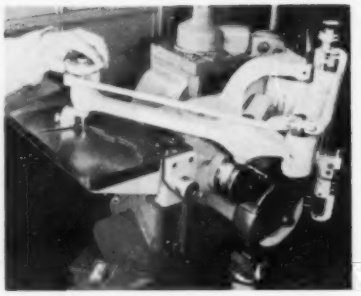
Wheel Forming Attachment

Model No. 5 wheel forming attachment for surface grinders is designed for permanent mounting on the spindle head. The swiveling tandem type diamond spindle has one diamond for semifinishing and a second for finish truing. To use the attachment, the operator traverses a tracer over the profile of a template and the path of the tracer is transmitted—at a 10:1 or 5:1 reduction ratio—to the truing diamonds.



Model 5-1 is for surface grinders with up to 6 x 18-in. table working surfaces; Model 5-2 is for grinders with 8 x 24-in. working surfaces.

Pratt & Whitney Co., Inc., Charter Oak Blvd., West Hartford 1, Conn. **Circle 402**

Stencil Marker

Battery powered portable electrolytic marker for permanent stencil etching of metals has three interchangeable stencil sizes for marks up to ½ x 1½ in. A reservoir tube provides fluid to the marking area. A spring actuated pin next to the stencil makes ground contact to create etching current at the mark area. This, with the electrolyte, completes the mark through the formed stencil.

The unit makes white or black marks. Both types of marks are permanent, penetrating to a depth of 0.0001-0.002 in.

The Lectroetch Co., 14925 Elderwood Ave., East Cleveland, Ohio. **Circle 403**

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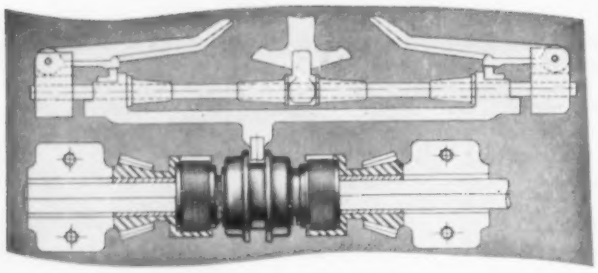
Grinder Converter

Any surface grinder can be converted into a precision OD, ID and centerless grinder with the portable attachment illustrated. For centerless grinding, the work rests on a motor-driven regulating roller. A variable control adjusts speed. For plunge grinding, a holddown bracket is inserted into the unit.

ROCKFORD



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PULLMORE discs provide high capacity, and efficient lever design, makes possible light engaging pressure. Discs are accurately made from special clutch-disc materials and are tested for flatness. Made in single and double types, for operation in oil or dry, PULLMORE clutches have capacities from 1 to 90 H.P. at 500 R.P.M. They handle loads of much greater than rated capacity, when operated at higher speeds.

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Shows typical installations of ROCKFORD CLUTCHES and POWER-TAKE-OFFS. Contains diagrams of unique applications. Furnishes capacity tables, dimensions and complete specifications.

Small Spring Loaded

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CLUTCHES

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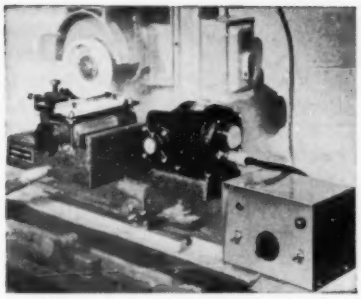


The bracket holds the work, and no chucking or indicating is required.

Unison Corp., 2843 Hilton Rd., Ferndale 20, Mich. **Circle 404**

Short-Flute Drills

Heavy-duty jobber length drills, in the 3300 series, are designed for drilling "superalloys" and high strength steels. They work efficiently at high temperatures and are used with either stationary or portable drilling units.

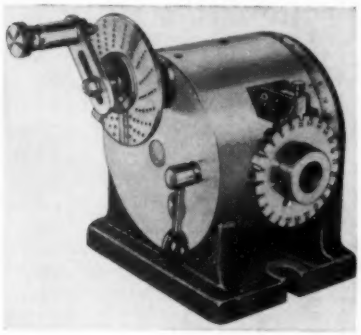
Made from eight percent colbolt high-speed steel with a high vanadium content, their short flutes give maximum rigidity and a special point design provides good penetration and thrust reduction.

National Twist Drill & Tool Co., Rochester, Mich. **Circle 405**

USE READER SERVICE CARD ON PAGE 171 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Direct Indexing Heads

Chuck dividing heads with direct indexing permit changing from conventional to direct indexing in less than a minute. Worm and wheel adjustment eliminates backlash. A 24-slotted plate



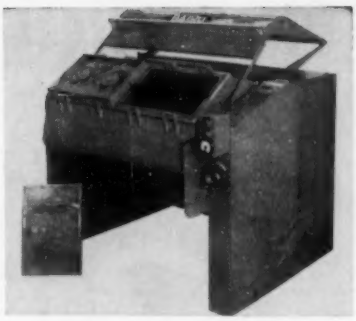
is standard equipment with direct indexing models. Machine blanks can be furnished.

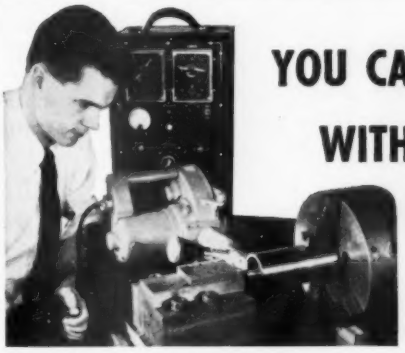
L-W Chuck Co., 45 S. St. Clair St., Toledo 4, Ohio. **Circle 406**

Barrel Finishing Machine

Horizontal barrel finishing machine has a variable speed drive of from 8 to 24 rpm and capacity of 2000 lb. Since the barrel is less than 4 ft high, loading and unloading equipment can be carried over the top. The barrel guard swings away, making the opening accessible for easy loading. Controls at the front of the unit make it possible to place machines side by side.

Baird Machine Co., Stratford, Conn. **Circle 407**





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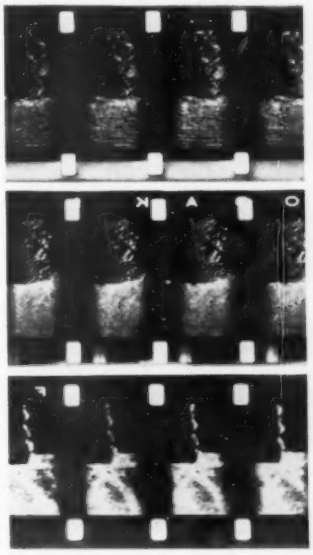
PROBLEM: *Differences in power consumption, chip formation and tool life when machining Titanium and steel.*

SOLUTION: *A high speed motion picture study of chip formation process of SAE 1020 and SAE 1112 steel being machined under same conditions as Titanium.*



2: SAE 1020 steel. Large built-up edge at cutting speed causes poor surface finish. Shear angle is low, resulting in very thick chip and consumption of considerable power in removing metal.

3: SAE 1112 steel. Built-up edge is absent due to lower friction on tool face . . . improved surface finish. Shear angle is higher and chip thinner. Power consumption is lessened.

4: TITANIUM (Ti 150A). No built-up edge. Surface finish is excellent. Shear angle high, but not constant in value. Chip forming process is cyclic. Since thin chip, power consumption is low. Tool life shorter because of metal structure.

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who's meeting and where

Nov. 2-6. AMERICAN SOCIETY FOR METALS. National Metal Exposition & Congress. International Amphitheatre, Chicago, Ill. Further information available from Chester L. Wells, Exposition Manager, Society for Metals, 7301 Euclid Ave., Cleveland 3, Ohio.

Nov. 2-6. SOCIETY FOR NONDESTRUCTIVE TESTING. 19th Annual Convention, Hotel Hamilton, Chicago, Ill.

Nov. 4. NATIONAL INSTITUTE OF MANAGEMENT, INC. One day seminar, Plastics Tooling, Sheraton-Blackstone Hotel, Chicago.

Nov. 4-5. NATIONAL INSTITUTE OF MANAGEMENT, INC. Seminar, Estimating Costs, Sheraton-Blackstone Hotel, Chicago.

Nov. 4-6. EASTERN ANALYTICAL SYMPOSIUM, Hotel New Yorker, New York, N. Y.

Nov. 4-6. INSTITUTE OF RADIO ENGINEERS (IRE-PGAC). National Automatic Control Conference with AIEE, ISA and IRE-PGIE, Sheraton Hotel, Dallas, Texas.

Nov. 4-6. PORCELAIN ENAMEL INSTITUTE. Shop Practice Forum, Ohio State University and Deshler Hilton Hotel, Columbus, Ohio.

Nov. 4-6. SOCIETY OF RHEOLOGY. 30th Anniversary Meeting, Lehigh University, Bethlehem, Pa.

Nov. 4-8. NATIONAL TOOL & DIE MANUFACTURERS ASSOCIATION. Annual Convention for members, Statler Hotel, New York, N. Y.

Nov. 8-13. AMERICAN SOCIETY OF MECHANICAL ENGINEERS, with ACS and ASTM. International Rubber Technology Conference, Shoreham and Park Plaza Hotels, Washington, D. C. For further information contact Meetings Dept., ASME, 29 West 39th St., New York 18, N. Y.

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Nov. 9-11. AMERICAN MANAGEMENT ASSOCIATION. Packaging seminar, Fundamentals of Packaging Specifications, Hotel Astor, New York, N. Y.

Nov. 9-11. STEEL FOUNDERS SOCIETY OF AMERICA. Technical and Operating Conference, Carter Hotel, Cleveland, Ohio.

Nov. 12-13. AMERICAN SOCIETY OF INDUSTRIAL DESIGNERS. Product planning and development conference, Statler Hilton Hotel, New York, N. Y. Further information available from A.S.I.D., 15 E. 48th St., New York 17, N. Y.

Nov. 16-20. AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Automation Show & Conference on Materials Handling, New York Trade Show Bldg., New York, N. Y.

Nov. 18. NATIONAL INSTITUTE OF MANAGEMENT, INC. One day seminar, Plastics Tooling, Sheraton-Blackstone Hotel, Chicago.

Nov. 18-19. NATIONAL INSTITUTE OF MANAGEMENT, INC. Seminar, Estimating Costs, Park-Sheraton Hotel, New York, N. Y.

Nov. 19. SOCIETY OF PLASTICS ENGINEERS, INC. Regional Technical Conference, Plastics in Packaging, Claremont Hotel, Berkeley, Calif. Additional information available from Frank D. Allen, L. H. Butcher Co., 15th and Vermont Sts., San Francisco, Calif.

Nov. 19-20. UNIVERSITY OF WISCONSIN EXTENSION DIVISION AND THE COLLEGE OF ENGINEERING. Engineering Institute, Industrial Fastener Applications, New Wisconsin Center Bldg., Madison, Wis. Additional information available from Richard A. McCormick, Institute Coordinator, University of Wisconsin Extension Div., Dept. of Engineering, Madison 6, Wis.

Nov. 29-Dec. 4. AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Annual Meeting, Chalfonte Haddon Hall, Atlantic City, N. J.

Dec. 1. NATIONAL INSTITUTE OF MANAGEMENT, INC. One day seminar, Plastics Tooling, Sheraton-Blackstone Hotel, Chicago.

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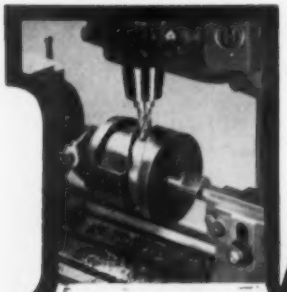

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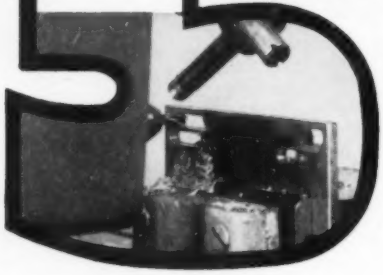

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good READING

AMERICAN INSTITUTE OF PHYSICS HANDBOOK—*By Dwight E. Grey, Coordinating Editor. Published by McGraw-Hill Book Co., Inc., 330 W. 42nd St., N. Y. 36, N. Y. Price $15. 1544 pages.*

This handbook will form an important working tool for those employing physical methods in research, application and teaching. It should prove especially valuable in this period of scientific development, particularly since the impact of wartime research and the expansion of the science of physics into many specialized fields. Over 100 subject areas are covered in the eight sections of the book: mathematics, mechanics, heat, sound, electricity and magnetism, optics, atomic and molecular physics, and nuclear physics. The book contains a wide range of tables, graphs and summaries of formulas in all fields of physics. It will be primarily useful to the unscientific investigator and will also have value as a reference work to the senior physicist. The topics represent data that is particularly new, unusual and not easily accessible elsewhere.

SIZING UP PEOPLE—*By Donald A. Laird and Eleanor C. Laird. Published by McGraw-Hill Book Co., Inc., 330 W. 42nd St., N. Y. 36. Price $4. 270 pages.*

Based on the sound psychological knowledge of individual differences, the material in this book is presented in easy-to-understand form. It emphasizes the practical application of modern psychological theories in many business situations.

Subjects covered by this book include how to avoid blunders in sizing up others, the way to judge people, how people differ, how human abilities are graded, and such diversified things as sizing up and improving intelligence and personality traits. Other chapters include the estimating of trustworthiness and making better use of abilities

in business. An important facet of sizing up people is discussed in the authors' method of analysis and primary rules for judging others.

NOMA Glossary of Automation Terms —*Published by the National Office Management Association, Willow Grove, Pa. Price $2. 35 pages.*

This glossary has been compiled to help establish a common understanding of the new language of automation. Scope of it is limited to the terminology of the technilogical operations of automatic data processing machines and their tasks.

NOMA Automation Bibliography—*Published by the National Office Management Association, Willow Grove, Pa. Price $2. 20 pages.*

This booklet contains a classified compilation of selected books, magazine articles and booklets which were published in the years 1953 through 1957 on the subject of automation.

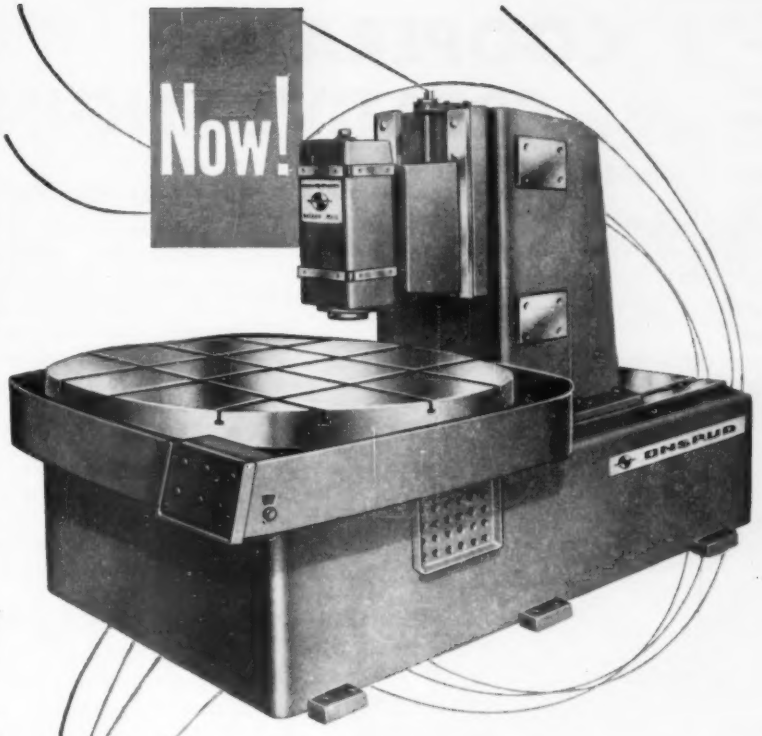
The Techniques of Delegating—*By Donald A. Laird and Eleanor C. Laird. Published by McGraw-Hill Book Co., Inc., 330 W. 42nd St., N. Y. 36, N. Y. Price $3.95. 200 pages.*

Getting things done through others can make the difference between success or failure for an executive. This ability to delegate is becoming one of the most important functions in the business world.

In addition to showing how to use delegation as a vital tool for the executive, the sociological and psychological implications of delegating are also included. Special features include self analysis quizzes, a check list of company symptoms, seven axioms to follow in planning delegation, seven axioms to simplify the job by delegation and forms used by business organizations to rate executives.

Dow Muriatic Acid—*Published by the Dow Chemical Co., Inorganic Chemical Sales, Midland, Mich. Available on request on company letterhead. 44 pages.*

Drawings, tables and graphs illustrate this manual which covers the history of muriatic acid, properties, principle reactions and industrial interest in the product. There are descriptions of loading and unloading muriatic acid, shipping containers and handling, storing, sampling and diluting the chemical. Other topics include health hazards, safety precautions and first-aid measures when using acids.



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156	166	176	186	196	306	316	326	356	366	376	386	396	406	7751
157	167	177	187	197	307	317	327	357	367	377	387	397	407	
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6	16	26	36	46	56	66	76	86	96	106	116	126	136	146
7	17	27	37	47	57	67	77	87	97	107	117	127	137	147
8	18	28	38	48	58	68	78	88	98	108	118	128	138	148
9	19	29	39	49	59	69	79	89	99	109	119	129	139	149
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Field Notes

An education program, "Getting Acquainted with Plastics", has been presented to over 100 groups of engineers by **Cadillac Plastic & Chemical Co.,** Detroit. The program covers properties and applications of a range of plastics now available in standard shapes, with emphasis on 11 major thermoplastic families and the glass-reinforced plastics.

V V V

R. G. LeTourneau, Inc. is offering its Steel Div. products to the open market. This move will make an additional supply of steel plate (which is often in short supply) available to southern industry. Steel meeting ASTM and AISI standards is available as well as high strength nickel alloy plate which the company has developed for fabrication of its heavy-duty equipment.

V V V

Exclusive license to produce and market a continuous filtering machine has been granted to the Chemical Machinery Div. of **Baker Perkins, Inc.,** Saginaw, Mich. Described as a push type, multistage centrifuge, the machine is a development of Escher Wyss Ltd. of Zurich, Switzerland.

new activities

Raytheon Co. has announced the appointment of Dr. Carlo Calosi to the newly created post of vice president—Europe. With the exception of the NATO Anti-Submarine Warfare Research Center in Italy, Dr. Calosi will be responsible for all Raytheon activities on the Continent and in the United Kingdom.

V V V

Chemical Milling International Corp., of El Segundo, Calif., has disclosed that it holds exclusive rights to a patent for contouring honeycomb core by chemical etching. This process is used in close tolerance matching of contoured core to specific skin design.

V V V

A motor which will spin the U. S. Army's Little John rocket as it is launched has been developed by Hamilton Standard, a division of **United Aircraft Corp.** Spin imparted to the rocket stabilizes the missile until it reaches sufficient speed for the control fins to be effective. "Little John" is designed for use by ground troops in the manner of conventional artillery.

V V V

Lockheed Aircraft Corp. has announced the opening of a top-level corporate office in Paris. A. B. Vosseller has been elected vice president in charge of company activities and interests in Europe, Africa and the Near East.

V V V

Dow Chemical Co. will offer 120,000 shares of common stock to its employees and the employees of certain associated companies. To be known as the 1959-60 Employees' Stock Purchase Plan, the offering will be the eleventh such plan since 1948.

V V V

Square D Co., producer of electrical equipment, has entered the Central European market with the opening of a subsidiary company, Square D GmbH, in Neuss am Rhein, Germany. Square D GmbH is the fourth such company established by Square D, other plant and sales sites being in Canada, Mexico and England.

V V V

An Atlantic Missile Range Office has been established by Aeronutronic, a Division of **Ford Motor Co.,** at the Air Force Missile Test Center, Patrick Air Force Base, Cape Canaveral, Fla. The new office will be responsible for supporting a program of flight testing of space vehicles, and will be used initially in connection with two classified Air Force programs which are entering the flight test stage.

V V V

Minneapolis-Honeywell Regulator Co. is building a second large-scale electronic data acquisition system for use in high-speed processing of rocket engine test information. The system will be installed at the Bacchus, Utah rocket propellant plant of Hercules Powder Co., which is developing a third-stage engine for the solid-fuel Minuteman, an Air Force "second generation" intercontinental ballistic missile.

V V V

Schwartz Chemical Co. of Long Island City, N. Y. has been named eastern distributor of a wide line of adhesives made by United States Rubber Co. The Schwartz company produces and distributes adhesives, cements, coatings for the plastic industries. The adhesives it manufactures are resin based, while U. S. Rubber's adhesives are of the solvent variety.

new facilities

Construction of a new semiconductor products plant by **Bendix Aviation Corp.** was started recently at Holmdel, N. J. The 72,000 sq ft facility, scheduled for completion next year, will be situated on a landscaped 118 acre plot. It will house manufacturing facilities, marketing offices, and engineering and research laboratories to handle the company's line of power transistors and silicon power rectifiers. Completely air conditioned, the facility will have a special humidity controlled area for precise control of semiconductor production.

V V V

A Radioisotope Laboratory, equipped and staffed for basic research and industrial applications of radioisotopes, has been installed by **Evans Research and Development Corp.** Major activities will be in the areas of radio chemistry and nuclear instrumentation.

V V V

Dow Corning Corp. has announced that it will build a technical service and development laboratory in Greensboro, N. C. This facility will be part of the Product Engineering Dept. under the direction of T. A. Kauppi in Midland. It will also do research and quality control work for Dow Corning emulsion and Specialty Products plants in Greensboro.

V V V

Micrometrical Manufacturing Co., Ann Arbor, is constructing a new facility designed to accommodate all manufacturing, engineering and research. The building will have 30,000 sq ft of floor space and will be located on a ten acre tract of land bordering the Detroit Industrial expressway. A 25 percent increase in employment is anticipated following completion of the plant.

awards

Federico Strasser of Santiago, Chile, has been named winner of the 1959 Presteel Award. Presented jointly by the Pressed Metal Institute and the Worcester Pressed Steel Co., the award annually recognizes substantial contribution to enlargement of the field of metal stampings. A partner in a leading Chilean manufacturing firm, Strasser has written a book, and a number of articles on the design of stampings and dies for THE TOOL ENGINEER.

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The new FRINGECOUNT micrometer opens up a whole new dimension in gaging. With this unique instrument, industrial organizations can now make absolute dimensional measurements to an accuracy of one-millionth of an inch under properly controlled conditions. Simple to operate, the FRINGECOUNT can be mastered quickly by industrial gage personnel . . . does not require trained physicists for effective results.

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association news

Society of Women Engineers will establish headquarters on the third floor of the projected United Engineering Building. To be erected on the United Nations Plaza, the 20 story building will be headquarters for many of the major engineering societies.

V V V

Members of the American Fair Trade Council, Inc. have voted to dissolve the 21 year old organization. Services of a new organization, Quality Brands Associates of America, Inc., will be made available to AFTC members. Development of a new concept of protection of manufacturers' property rights has been cited as a reason for creation of the new organization.

V V V

New member-companies of the Material Handling Institute, Inc. are Insul-8-Corp., San Carlos, Calif., and the Moto-Truc Co., Cleveland. MHI is a national trade association composed of 90 member-companies who manufacture all types of industrial material handling equipment, or offer related industry services.

new companies

Marquardt Corp. has announced establishment of the Nuclear Systems Div. whose functions will be aimed at the development and manufacture of nuclear propulsion systems and other nuclear products. The new division will become a line organization in the Power Systems Group under Don L. Walter, Vice President. Primary initial responsibility of the division will be work on project PLUTO. Future plans include a reactor assembly and critical facility, and "hot labs" to be located near Van Nuys, Calif.

V V V

Formation of Solar Engineering Corp. has been announced by Joseph A. Brust and James D. Vaughan of Detroit. Solar services include product, tool and machine design, and manufacturing engineering.

V V V

U. S. Industries, Inc., has added to its group of foreign subsidiaries by the formation of a new company in England called U. S. Industries, Inc. (Great Britain) Ltd. The new European activities of two of USI's principal divisions—the Clearing Div. and the International Div. Clearing is a manufacfacturer of metalforming presses and other machine tools. USI's International Div. is a world wide trading organization with offices in most principal countries of the world.

Officers of the Garlock Packing Co. have announced completion of negotiations to manufacture mechanical packings in Mexico City. Garlock de Mexico, the name of the new subsidiary, is a joint venture of Garlock and their Mexican distributor, Louis Mulas, Sucs., S.A. The Mexican enterprise will represent an investment of $750,000.

moves

Prenco Products, Inc. and **Prenco Manufacturing Corp.** have moved into their new plant in Royal Oak, Mich. The companies are manufacturers of sealants for impregnation of castings and impregnation machinery.

√ √ √

Diamond Dust Co., Inc. has moved from Glendale, L. I. to Mineola, L. I. With its new facilities, Dia-Dusco is establishing a service bureau which will assist industry in connection with problems of lapping and polishing, and diamond dust reclamation from waste material.

acquisitions

C. O. Bartlett & Snow Co. has acquired the Wettlaufer line of vibrating screens, packing units, blender mixers, granulaters and centrifuges.

√ √ √

Rolle Mfg. Co., of Lansdale, Pa., a major producer of aluminum and magnesium castings, has been acquired as a wholly owned subsidiary by DEK Industries, Inc. DEK, a manufacturer of aluminum products, purchased Rolle facilities as part of its long range program for growth and diversification in the light metals industry.

√ √ √

General Controls Co., a producer of automatic controls for military, industrial and residential applications, has purchased Wirepots, Ltd., a British manufacturer of dials and potentiometers. Production of the parent company's line of potentiometers will be shifted from Burbank, Calif. to England. New items, as well as additions to the potentiometer line, will not be relocated in England until they have been tested on the U. S. market.

√ √ √

National Acme Co., manufacturers of machine tools, has announced the purchase of Shalco Corp., Palo Alto, Calif. Shalco is a developer and manufacturer of shell core and shell molding machines. Shell molding, developed in Germany during the second World War, was brought to this country in 1947 by the U. S. Government and placed in the public domain.

Ohio Knife Co., Cincinnati, has announced the purchase of the manufacturing rights to the John M. Rogers inserted blade type reamers and mills from The Oak Engineering Co., Gloucester, N. J. Rights include the patents for inserted blade type hand reamers, chucking reamers, shell reamers and hollow mills.

expansions

Lockheed Missiles and Space Div. has announced the transfer of the major functions of its advanced satellite programs into its newly activated Satellite Production building. The 346,000 sq ft building will be headquarters for the Discoverer, Midas and Samos satellite development. Activation of the facility involved a move of nearly 2500 scientists, engineers and administrative support personnel.

√ √ √

Universal Grinding Corp., Cleveland, has undertaken its second major expansion since 1958 by erecting a 27,000-sq ft addition. The company now employs 95 production grinding machines and will add 25 more units with completion of its expansion.

√ √ √

Taylor Fibre Co. has occupied a new three story research center on the company's main plant site near Norristown, Pa. The move has been accompanied by an intensification of the company's research program in basic chemistry and physics of vulcanized fibre and laminated plastics. Research contracts in the past include development of silicon-glass high-pressure laminates and high heat-resistant laminates for the Navy's Bureau of Ships.

√ √ √

Norden Div. of United Aircraft Corp. has acquired an 80-acre tract in Norwalk, Conn., on which it will build a multimillion dollar engineering-research and manufacturing facility. Construction of the Norwalk facility will consolidate Norden operations now carried on at Stamford and Milford, Conn., and White Plains, N. Y. The division's operations in Long Island and Gardena, Calif. are unaffected by the consolidation.

√ √ √

General Electric's Insulating Materials Dept. has announced plans for a five-year, multimillion dollar expansion program in Schenectady. First step in the proposed expansion will involve the expenditure of over $1,000,000 to modernize existing facilities, establish new processes and construct a new manufacturing (headquarters) facility. The move will aid the company in developing new products for industry.

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the newest concept in band saw blades—made from L-100-M, a double carbide alloy developed especially for band saws. Its hot hardness and abrasion resistance effect extraordinary results.
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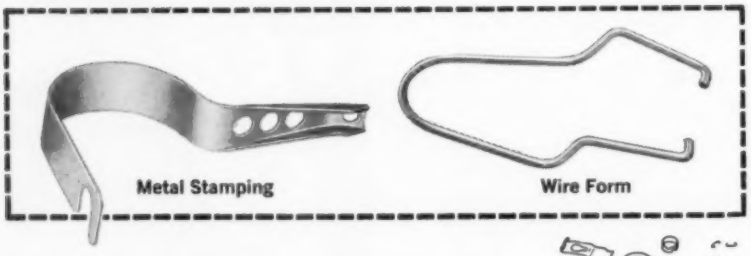
3. Job Versatility through Quick-Change Cams
4. Combine Stamping & Forming in 1 Machine



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Wire up to ½" diameter
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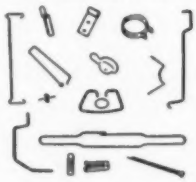

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USE READER SERVICE CARD, CIRCLE 86

.....readers' viewpoints

. . . nitrided dies

To the Editor:

Mr. S. Bergman's article "Nitriding Improves Die Life" in the September issue of THE TOOL ENGINEER should be supplemented with additional information. For example, what type of steel was used for the punch and die?

A second question deals with the thickness and type of the blanked material. This item is also very important since nitrides are extremely brittle, which places a limitation on the blanking of various thicknesses and materials. One should keep in mind that nitrides cannot be tempered back for toughness. A nitrided case on cut edges should never exceed 0.010 in. total and should be attempted on a trial basis.

Mr. Bergman states that he had very good results with nitrided drills. Such drills are always nitrided in a liquid salt bath and have a maximum case depth of 0.0015 to 0.0025 in. One should avoid nitriding high-speed steel cutting tools in a gaseous atmosphere.

Has Mr. Bergman considered the use of a D-2 or D-3 type of tool steel for the die hardened to 58-60 R_C (using a high double draw) and an S-5 type for the punch hardened to 48-50 R_C for "peening"? This is a standard procedure in the can industry.

If Mr. Bergman used the D-2 or D-3 type of tool steel, this writer can only conclude that the die and punch were too hard (62-64 R_C) and too brittle to maintain a keen, tough cutting edge. Where maximum production runs are expected, it is essential to obtain complete transformation in the structure or fatigue failures of the cutting edges will develop in use, or in grinding prior to use. The necessary transformation can be accomplished by hardening from recommended temperature and double-tempering at 940 F for the first draw and 925 F for the second draw. Resulting hardness will be 58-61 R_C. Another method is to quench from the recommended hardening temperature, temper at 375 or 400 F, then deep freeze at -120 F, followed by a 400 F temper. This results in a hardness of 60-62 R_C. These treatments give complete transformation with practically no retained austenite, which is a major cause of galling and metal pick-up, and which makes grinding difficult.

Louis Malpocker
Tool Steel Engineer
Ford Steel Co.
St. Louis 10, Mo.

To the Editor:

The steel in question is Neor tool steel (high carbon, high chromium, no tungsten, no vanadium, no molybdenum). We have experimented with the steels suggested by Mr. Malpocker without any appreciable improvement in die life. It is much simpler to nitride than to process and reprocess as Mr. Malpocker suggests. Nitriding is cheap and the life of our nitrided steel dies equals that of carbide dies. This writer would not gas nitride high speed steel.

S. Bergman
F. L. Smithe Machine Co., Inc.
New York 36, N. Y.

. . . box tool research

To the Editor:

There is a tendency in some machining research to radically depart from actual production conditions. A striking example of this was Horace Frommelt's article "Using Carbides with Box Tools" in the July, 1959 issue of THE TOOL ENGINEER. The article contains the statement: "The exploratory work was performed on a Kearney & Trecker 50-hp milling machine, which for this purpose was converted to a lathe. A chuck was mounted on the spindle nose of the milling machine."

Such experiments would be much more useful to tool engineers, planning engineers and turret lathe operators if they were conducted on the same type of machines used for production. There is little relation between the use of a milling machine for research on box tools and the actual application of box tools in a turret lathe.

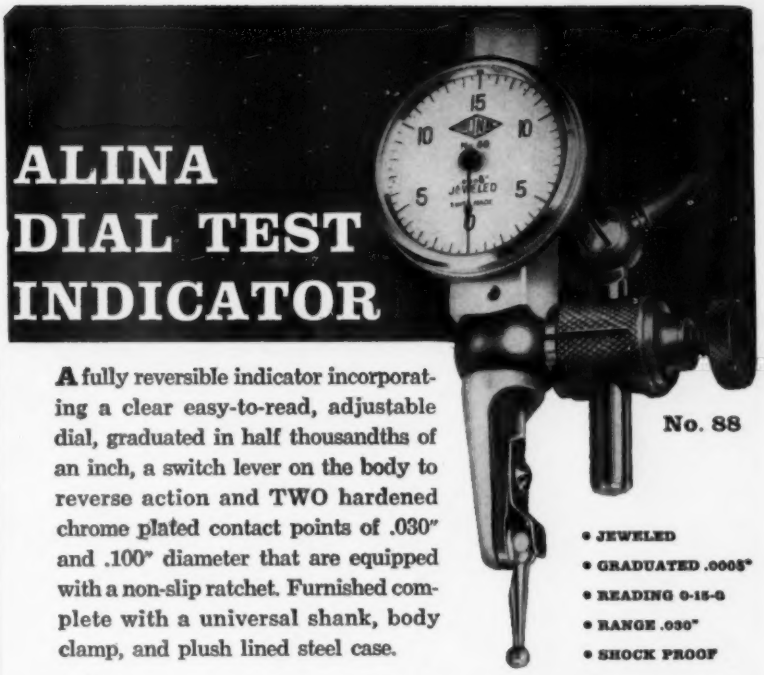
Mr. Frommelt lists the power consumption with carbides as averaging 6.7 hp. Turret lathes and automatic screw machines in use today are driven by motors larger than 6.7 hp and the tests could have been run on such machines. The information reported should have been applicable to current production conditions, in order to be of direct value to tool engineers responsible for box tool operations.

Lester G. Detterbeck
Technical Publications Chairman
Tucson Chapter

To the Editor:

The following explanation may assist in evaluating the article. The operation referred to was performed for the Brown Instruments Div. of Minneapolis-Honeywell. It has been transferred to Brown Instruments production line and is being performed using operating characteristics indicated in the article. This operation proved completely successful under actual shop conditions.

Horace Frommelt
Spring Garden Institute
Metal Removal Center
Philadelphia 23, Pa.



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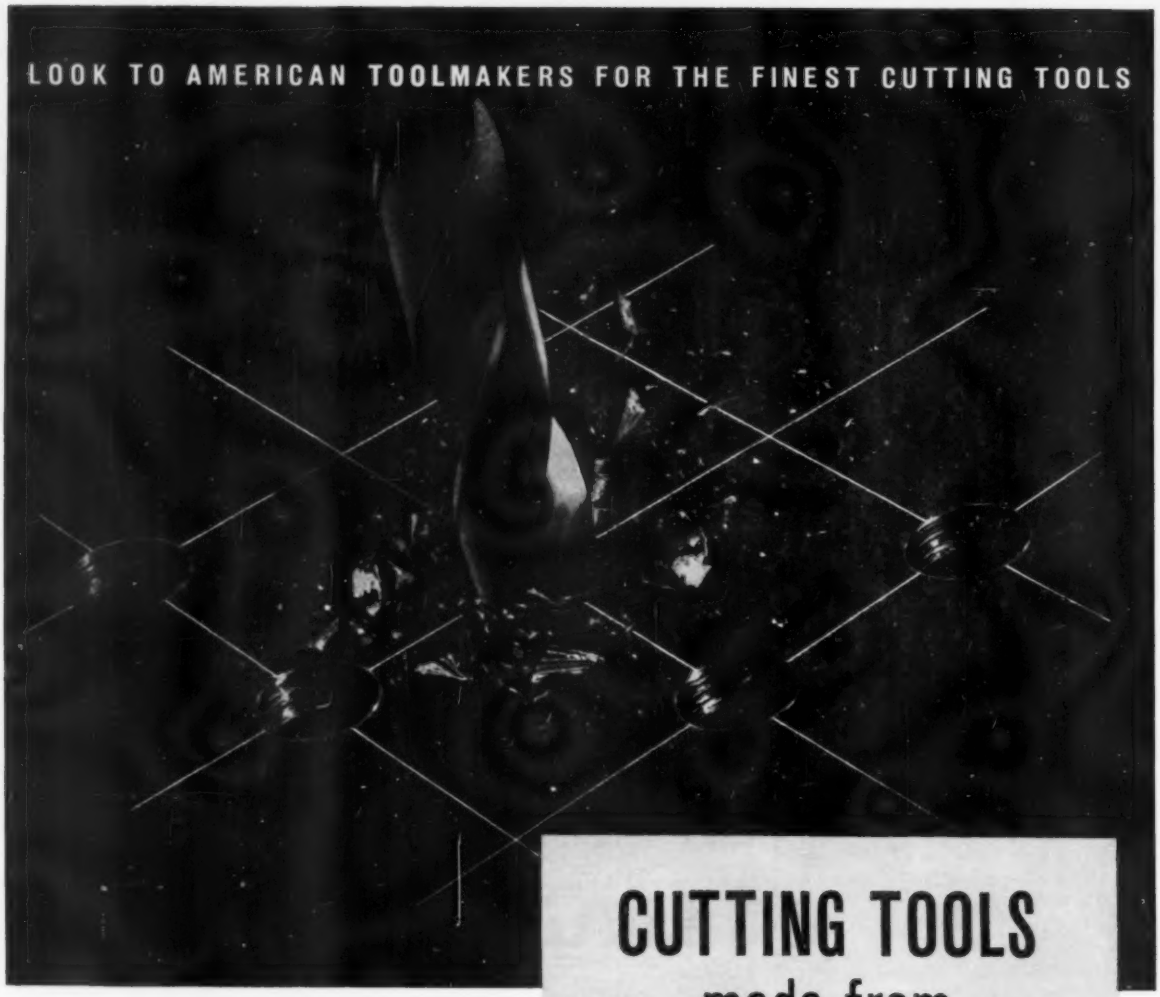
LOOK TO AMERICAN TOOLMAKERS FOR THE FINEST CUTTING TOOLS



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Carra L. Lane, left, has been appointed manager of plant operations for the Chicago Pneumatic Tool Co. All manufacturing and engineering operations in the company's domestic plants will be under his jurisdiction. From his headquarters in New York, he will coordinate operations of the company's wholly owned subsidiaries in Conn. and Ind.

A. Lee Graham, right, plant superintendent of the American Forge & Mfg. Co. for the past 11 years, has been named vice president in charge of operations. Graham, formerly with Westinghouse Air Brake Co., was superintendent of the tool and die shop for the Frank Alston Co. He is a graduate of Pittsburgh Technical Institute.

Men at Work

EDWARD A. VOSS has been appointed manufacturing manager of the Cincinnati Div. of Bendix Aviation Corp. He will be in charge of all fabrication, assembly and manufacturing operations. He has been with various company divisions since 1941.

CARL B. WILLE, formerly director of engineering for The Carborundum Co., has been promoted to general manager of the company's Curtis Machine Div. He has been with Carborundum since 1953.

The Onsrud Machine Works, Inc. has announced the appointment of THEODORE F. ESERKALN as chief engineer. His responsibilities include engineering design and development, specifications and final test procedures.

EDWIN B. WATSON has been named chief engineer of the Diesel department at the Scintilla Div., Bendix Aviation Corp. He has been associate professor of mechanical engineering at Cornell University since 1947.

CHARLES F. SIMMERS has been appointed assistant chief engineer, Engineering and Construction Div., Koppers Co., Inc. A specialist in steel mill rolling equipment and special steel mill crane design, Simmers will assist in the execution of engineering design for industrial and steel mill plants, furnaces, sintering plants, by-product coke plants and special equipment. He has been associated with the Morgan Engineering Co., United Engineering and Foundry Co., Berger Engineering Co., and U. S. Steel.

RUSSELL A. HEDDEN has been appointed works manager of manufacturing, Industries Group, at Allis-Chalmers West Allis (Wis.) Works. He succeeds E. W. BONNESS who has been named consultant to the director of manufacturing of the Industries Group.

E. K. LEAVENWORTH has been appointed a vice president of Climax Molybdenum Co. of Michigan. He will continue to be headquartered at the Coldwater, Mich., plant where he serves as works manager.

LESLIE M. HESS has been elected vice president and assistant general manager of the Landis Machine Co. E. C. HANNA has been elected to the newly created post of director of engineering, and is succeeded by GEORGE W. LYMAN as chief research engineer.

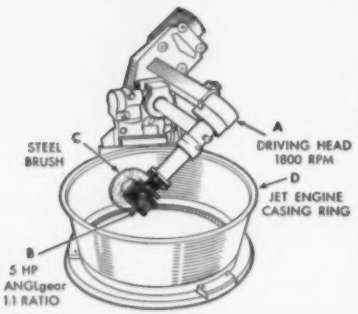
Donald C. Duncan, director of contract sales for Beckman Instruments, Inc., has been named president of Pacific Electronic Controls Corp. A leader in the field of precision potentiometers, Duncan joined Beckman in 1946, was appointed assistant general manager in 1949, and subsequently became vice president and general manager.

Announcement has been made of the appointment of Geoffrey Paget as chief metallurgist for the Shaw Process Development Corp., Port Washington, N. Y. Well-known in England and Canada, Paget is an Associate of the Institute of Metallurgy and a member of the American Society of Metals and the Institute of British Foundrymen.

The appointment of Stanley R. Curtis as project engineer has been announced by Tranter Mfg. Inc., Lansing, Mich. A 1949 mechanical engineering graduate of Michigan State University, Curtis was formerly a senior project engineer and group leader in the gas heating appliance department of the Motor Wheel Corp.

Thomas W. Morrison has been appointed director of engineering and research for SKF Industries, Inc. He will replace vice president Gunnar Palgren who retires at the end of the year. A mechanical engineer, Morrison joined the company in 1936 as a machinist in the research laboratory. He is a graduate of Drexel Institute of Technology.

ANGLgear® simplifies power-brush drive

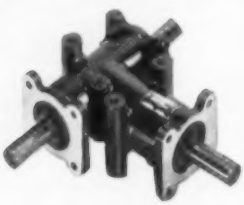


Drawing shows ANGLgear application on Osborn Brushamatic® unit developed for finishing jet engine case components. ANGLgear permits compact design, has capacity to withstand reversal every 20 sec. without overheating.

Osborn Manufacturing Co., a Cleveland, Ohio, producer of power-brush finishing machinery, has found ANGLgear ideal for adapting brushing heads to right-angle drive. Offering high capacity for its size, ANGLgear permits compact head design, facilitates brushing in restricted spaces. At the same time, its light weight cuts the overhung load to a minimum, helping reduce bearing wear. And it has the stamina to meet operating conditions that include reversal every 20 seconds —without overheating or undue wear.

Perhaps ANGLgear can solve a similar 90° drive problem for you. Completely enclosed, permanently lubricated, and featuring universal mounting, it is easily incorporated in your power transmission systems and requires little or no maintenance.

You can specify standard ANGLgear in ⅓, 1, 2¼ and 5 hp ratings, with 1:1 or 2:1 gearing and 2 or 3-way shafting. See data in Sweet's Product Design File or contact our local distributor.



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John N. Davenport, left, has been elected president of Fulton Foundry & Machine Co., Cleveland, and Edward Borkholder, right, has been named the company's vice president-sales and sales manager. Davenport, who has been vice president and general manager since 1958, succeeds Frank L. Barton who is retiring after 43 years with the company.

BRUCE L. WILSON, formerly chief of the Engineering Mechanics Section, has been appointed chief of the Mechanics Div., National Bureau of Standards. He will direct a program involving mechanical standards of sound intensity, shock and vibration, pressure, force, mass, and rate of gas and liquid flow; the development of measurement techniques and transfer standards for the dissemination of these standards to science and industry; the determination of the density of solids and the constant of gravitational force; and studies of the properties of materials and structures.

Appointment of ADRIAN MARMOR as president and general manager has been announced by the Bilgram Gear & Machine Works, Philadelphia. Marmor was formerly a director and member of the executive staff of the Hale Fire Pump Co.

M. M. ANDERSON has been named vice president-engineering of Stran-Steel Corp. Headquartered in the recently completed engineering center in Terre Haute, Ind., he will have responsibility for product development and all other engineering functions. Anderson was formerly chief engineer for the company.

Allied Products Corp., Detroit, has announced the appointment of EDWARD M. MACDOUGALL as general manager of its Richard Brothers Punch Div. MacDougall, a Ford Motor Co. executive for 25 years, succeeds L. E. COULTER who was elevated to president in 1958.

FRANK X. BUJOLD has been named general manager of Frauenthal Div. of The Kaydon Engineering Corp., Muskegon, Mich. He has been with Ford Motor Co. for 10 years, recently serving as manufacturing manager of foundries, Engine and Foundries Div.

ROBERT L. ALLEN has been named president of the Solar Chicago Div., U. S. Industries, Inc. Allen has been general sales manager for the division for two years.

RICHARD C. HENSHAW has been appointed manager of operations at Lord Mfg. Co. He assumes over-all responsibility for activities of the engineering, manufacturing and marketing divisions of the company. Henshaw has been with Lord since 1938, holding a succession of supervisory and managerial positions.

The appointment of LEON C. KOENIG as vice president of manufacturing has been announced by Lingberg Engineering Co. A company founder, Koenig has been assistant secretary and plant manager.

The board of directors of The Timken Roller Bearing Co. has elected D. A. BESSMER president of the company to succeed WILLIAM E. UMSTATTD. H. E. MARKLEY has advanced to the position of executive vice president. JOSEPH C. SELBY has been named manager of quality control, domestic and international, and ROBERT W. DORN has been promoted to chief inspector, Canton and Gambrinus factories.

The Micromatic Hone Co. has announced the appointment of William J. Pinkerton, left, to the position of executive vice president and assistant general manager. Gerald Carlisle, right, secretary and treasurer of the company, has been appointed to the board of directors to fill a vacancy created by the death of Hubert E. Hartman.

Trade Literature

for free booklets and catalogs—use request card, page 171

Titanium Alloy

Heat-treatable titanium alloy, developed to meet the requirements of high-speed aircraft, is the subject of a 24-page manual, "Properties of Ti-4Al-3Mo-1V." The handbook covers physical, mechanical and design properties of this high-strength alloy, its response to heat treatment and its fabrication characteristics. Included are data spelling out the alloy's creep resistance and its dimensional stability during heat treatment and service life. Titanium Metals Corp. of America, 233 Broadway, New York 7, N. Y.

Circle 301

Small Basic Switches

This 20-page catalog covers four Micro Switch groups—type V3, postage-stamp-sized switches; type TB two-circuit switches; type 1SX1 subminiature switches and type SM subminiature switches. Typical auxiliary actuators and assemblies are shown with each of the four types. The catalog contains details on almost 100 switches, actuators and assemblies. Catalog 63, Micro Switch, Freeport, Ill.

Circle 302

Mechanical Drive

A recently published six page folder describes the Allispede mechanical adjustable speed drive, which has broad application in such industries as material handling, dairy, food and chemical processing, woodworking and machine tools. The drive operates on power, offers speed ranges up to 8:1 and is available in ratings from 1 to 30 HP. The bulletin gives engineering and application information, including a cutaway view of a typical Allispede unit. Also illustrated are modifications to the basic drive, such as remote controls, mounting flanges, brakes and remote speed indicators. Graphs point up the speed regulation benefits gained by using a synchronous induction motor (optional) in the drive. Bulletin 3600, The Louis Allis Co., Milwaukee 1, Wis.

Circle 303

Cemented Carbides

A revised 32-page handbook, "Carmet Catalog C-16-B," contains a number of important changes over material previously distributed. Information covers brazed tools, inserts, toolholders, blanks and product and price changes. Advertising Dept., Allegheny Ludlum Steel Corp., Oliver Bldg., Pittsburgh 22, Pa.

Circle 304

Drill Heads

Five new catalog sheets describe the complete series of Cleveland Pneumatic/Johnson drill heads. The bulletins illustrate design advantages, construction features and dimensions, and list recommended spindle sizes for various drilling jobs. Cleveland Pneumatic Industries, 64 Old Orchard, Skokie, Ill.

Circle 305

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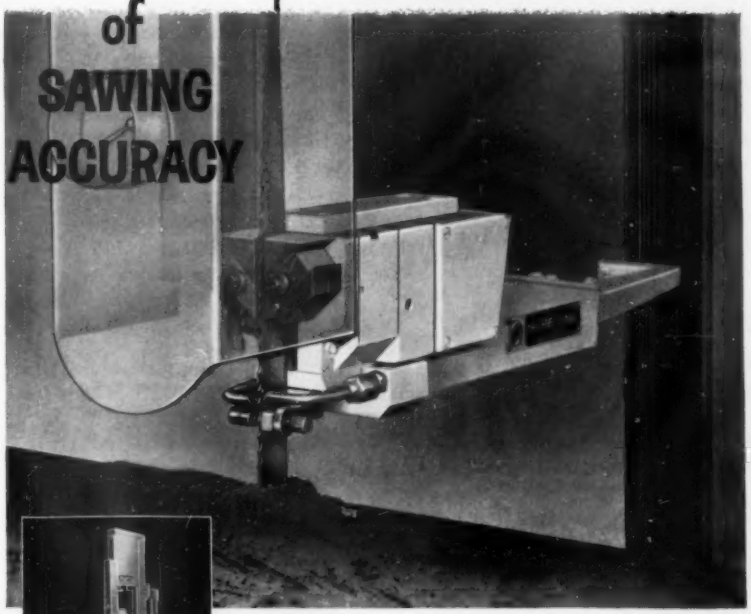
GUIDANCE SYSTEM*
...SECRET of SAWING ACCURACY

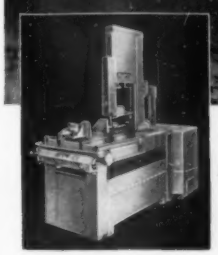
A new MARVEL invention—the "Sure-Line" Automatic Blade Controller—*at last* attacks the problem of maintaining accuracy in high speed band sawing.

This simple, but effective electro-mechanical guidance system invented and developed by MARVEL, actually "steers" a band blade while it is cutting, to maintain a straight path!

Designed as an integral part of, and available only in the new MARVEL 81 Series All Hydraulic Band Saws, the "Sure-Line" guidance system continuously senses and automatically corrects any tendency of a band blade to cut inaccurately. Now—with the MARVEL "Sure-Line" guidance system, every square inch of cutting life is squeezed out of each blade. The result: longer blade life, and cutting costs lowered to a point that makes high speed production cutting-off with a band saw economically practical.

A demonstration of the new MARVEL No. 81 All Hydraulic Band Saw will prove it. Write today for the complete story, and ask about a demonstration.





*SURE-LINE AUTOMATIC BLADE CONTROLLER (BASIC PATENT APPLIED FOR)

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Metal Cutting MARVEL SAWS
Better Machines—Better Blades

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interchangeable with all standard JIC cylinders

With the introduction of the ALL NEW T-J Squair Head, Tomkins-Johnson now offers industry the most complete design range of air and hydraulic cylinders. Presently available in bore diameters from 1-½ to 8 inches, the T-J Squair Head is an interchangeable cylinder which produces maximum force and efficiency, with minimum pressures . . . and is also adaptable to the use of low pressure oil as the working medium. Write today to The Tomkins-Johnson Co., Jackson, Michigan, for Bulletin #SQ 10-58 and complete details.

CHECK THESE 10 POINTS OF T-J SUPERIORITY

1. One Piece Piston
2. Hard Chrome Cylinder Bore and Piston Rods
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4. Cushion Adjusting Screw, Externally Adjustable
5. New Super-Cushion for air, or Self-Aligning Master Seal for oil (T-J Patents)
6. Solid Steel Heads and Mounting Plates Standard all Models
7. Port Design Allows Minimum Pressure Drop on Inlet or Outlet
8. Chevron Type, Self-Adjusting Rod Packing
9. Piloted Packing Gland—Absolute Alignment
10. Piston Rod, Extra Strong—Polished and Chrome Plated for Efficiency and Protection

T-J TOMKINS-JOHNSON
RIVETORS . . . AIR AND HYDRAULIC CYLINDERS . . . CUTTERS . . . CLINCHORS

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Drill Bushings, Work Locators

The Flar-A-Lock drill bushing and work locator for installation in light gage tooling material, with the use of a hand flaring tool and hammer, is described in catalog No. 103. Also included are illustrations, specifications, prices and technical information. Techno-Products Corp., 407 Baily Rd., Yeadon, Pa. **Circle 306**

Barrel Finishing

A seven-point system for scientifically controlled barrel finishing is detailed in "CARBOtrol 7." The booklet sets forth size and type of media; ratio of media to parts; load height; water; compounds; barrel speed; and tumbling time. A complete line of tumbling media, barrel finishing compounds and precision barrel finishing machines and equipment is listed for the full range of tumbling operations. Advertising Branch, The Carborundum Co., Niagara Falls, N. Y. **Circle 307**

Hydraulic Press Brakes

A bulletin describing a new line of hydraulic press brakes highlights a selection chart which shows the essential differences between mechanical and hydraulic brakes in use, tonnage, stroke, speed, accuracy and ram adjustment. Principal features of the design are detailed in a large illustration. Complete specifications and die space dimensions are given for all 44 models in the 200-1000 ton line. Niagara Machine & Tool Works, Buffalo 11, N. Y. **Circle 308**

Solenoid Valves

The purpose of the booklet, "How to Specify Solenoid Valves," is to eliminate the waste of time and money caused by "insufficient and incomplete specification of what the valve must do with what media under what conditions and for how long." Included are sections of solenoid valve nomenclature and a description of various types of valve sealing; a discussion of mechanical specification criteria including application description, fluid characteristics, pressure, valve capacity, leakage, valve life, speed of valve operation and valve envelopes; electrical specification criteria including explanation of solenoid, duty, electrical connections and coil construction; and environmental specification criteria covering application environment, testing and test specifications and safety.

Valcor Engineering Corp., 365 Carnegie Ave., Kenilworth, N. J. **Circle 309**

Finishing Machine

A 4-page, color brochure describing a new Roto-Finish Vibration precision finishing machine includes a diagram illustrating how the action of the Vibratron differs from conventional barrel finishing equipment; describes the design features of the machine; and provides detailed information on how the machine works. Illustrated case histories show before and after parts photographs and detail complete information, time cycles, and finishing results. The brochure contains machine specifications and lists sizes and optional equipment available. Roto-Finish Co., Kalamazoo, Mich. **Circle 310**

Mechanical Gap Presses

A 12-page bulletin on Oliver-Farquhar OBI mechanical gap presses illustrates and describes construction and operating features and includes data on two series available in 75, 110, 150 and 200-ton capacities. Bulletin M-1000, The Oliver Corp., A. B. Farquhar Div., 130 N. Duke St., York, Pa. **Circle 311**

Tool Steel

A 12-page booklet contains detailed information about Tri-Tung steel's characteristics, uses and machinability, with chapters on forging, annealing, stress relieving, hardening, tempering, martempering, subzero treatment and grinding. Graphs provide information on the effects of time and temperature on hardness, the effects of tempering temperature on Rockwell C hardness—core hardness, isothermal transformation and other factors. The Uddeholm Co. of America, 155 E. 44th St., New York, N. Y. **Circle 312**

Forging

Advantages of using aluminum forgings in all types of metal fabrication are presented in detail in a new book, "Kaiser Aluminum Forgings—Product Information." The 336-page volume describes various types of forging processes. More than 200 illustrations are included and numerous forged aluminum products are shown. Evidence is presented to demonstrate how such forgings can improve many items and reduce production costs for parts and assemblies. Available without charge when requested on company letterhead. For personal libraries, cost is $7.50. Technical Publications Dept., Kaiser Aluminum & Chemical Sales, Inc., 1924 Broadway, Oakland 12, Calif. **Circle 313**

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DR-25
OPTICAL GAGE

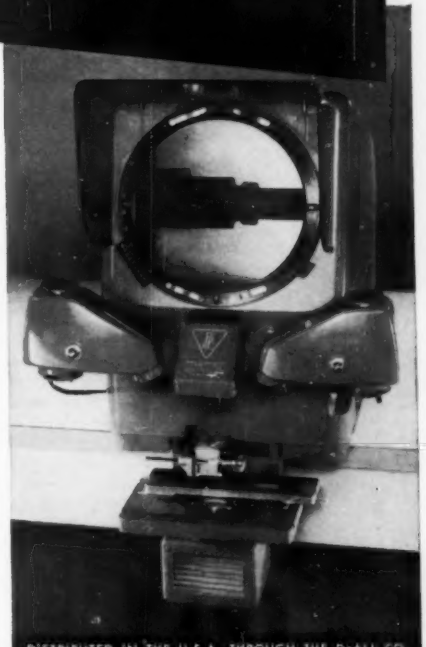
Now it's easy as A-B-C to get direct scale readings to .0001" . . . anywhere in the 0" to 3" range.

A Set part on anvil—no masters or set gages needed.

B Turn knob to lower spindle—stops automatically on contact.

C See precise measurement at a glance—illuminated, magnified, direct-reading scale.

PRECISION MEASUREMENTS...*FAST!*



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MEASURING
BENCH COMPARATOR

With the micrometer stage, the B&L Bench Comparator is the ideal tool for direct visual comparisons and for linear measurements to .0001". Now two new accessories add to its versatility:

- Protractor Ring provides quick, easy vernier readings to 5′ of arc.
- Surface Illuminator concentrates intense light on the work, exactly matching the area of each objective.

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☐ and demonstration
☐ I want Bench Comparator Catalog D-297
☐ and demonstration

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COMPANY.....
ADDRESS.....
CITY..... ZONE..... STATE.....

USE READER SERVICE CARD, CIRCLE 93

Milling Cutters, Gear Hobs

A 36-page engineering manual on multiple thread milling cutters and fine pitch gear hobs contains material on all phases of threading by the multiple thread milling process and the hobbing of fine pitch gears, including advantages, uses, application, sharpening, recommended feeds and speeds, thread generating and engineering data. Hanson-Whitney Co., Hartford, Conn.

Circle 314

Abrasive Finishing

A new data sheet covers the abrasive finishing of aluminum and magnesium and their alloys. Complete data on wheel heading, lubrication, speed and type of buff are included. The sheet covers satin, matte, butler and bright finishes. Instructions are applicable to such forms as castings, formings, extrusions, spinnings and stampings. The Lea Mfg. Co., 16 Cherry Ave., Waterbury 20, Conn. **Circle 315**

CONTOUR GRIP

SET UP ANY JOB IN SECONDS
then take deeper cuts, faster feeds

on a lathe...Contour Grip works with any two, three or four jaw chuck, wrench or air operated.

on a milling machine ...Contour Grip makes high speed milling of tough-to-hold parts easy.

on a grinder...this multiple set-up on a Blanchard helped a manufacturer increase his output ten-fold!

Any tool becomes more productive when you use Bliss' new Contour Grip holding fixture; any operator becomes faster.

Contour Grip is a standard fixture that will hold any irregularly shaped part so tightly that you can feed faster and take deeper cuts. It can be used with *any* type of tool, eliminating the need for costly special-purpose jigs and fixtures. And, as picture above shows, your operator can set-up Contour Grip in seconds, then go from piece to piece just by backing off the jaws, dropping the next piece in and tightening up. For long runs or short, it's as simple and as quick as that.

The key to this all-purpose holding fixture's versatility is its individual steel fingers, each of which moves independently as it contacts the work. The fingers mold around the part, and then tighten up *giving greater holding power and a more positive grip than any ordinary fixture can.*

To learn how Contour Grip works and to see the various models available, see your local dealer or contact us direct.

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1400 Brookpark Road
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Available in Canada through John Bertram & Sons, Ltd. Dundas, Ontario

USE READER SERVICE CARD, CIRCLE 94

Ultrasonic Cleaning

A 12-page ultrasonic cleaning primer is available for use as a guide by potential users of ultrasonic cleaning equipment. The primer is designed to provide a clearer understanding of what ultrasonic cleaning is, how it works, areas in which it can be employed and various solvents and detergents available for use with this kind of equipment. National Ultrasonic Corp., 111 Montgomery Ave., Irvington, N. J. **Circle 316**

Micropolish Units

Micropolish units for grinding and polishing coils, blanks, and sheets in all materials are described in an 8-page brochure. The literature discusses features and advantages of the micropolish units and gives detailed engineering specifications. Photographs and descriptions of auxliary equipment and variations and combinations of units are included. Form S9-1, Murray-Way Corp., P. O. Box 180, Birmingham, Mich. **Circle 317**

Collets, Feeders

Sutton Tool Co. has published a 24-page catalog illustrating and describing collets and feeders for use on automatic screw machines, turret lathes, engine lathes, milling machines and grinders. Price lists, ordering instructions, cross-section views and descriptions accompany each type of collet. Several pages illustrate and describe special tools designed to handle unusual workholding problems which cannot be solved by standard equipment. Catalog No. 23, Sutton Tool Co., Sturgis, Mich. **Circle 318**

Titanium Metals

A comprehensive handbook outlines corrosion resistant properties of titanium metal and its design and fabrication characteristics. The 36-page technical presentation, "Titanium Metals Handbook for the Chemical Processor," covers titanium's behavior in some 200 corrosion environments. Guides are established for use of conventional equipment for tube and sheet metal bending, drawing, surface treatment, machining, annealing, pickling, welding, and assembly. Also included is the ASME Boiler Code interpretation covering titanium's use in unfired pressure vessels, along with case history data, titanium metal weight tables, and size ranges of titanium mill products. Titanium Metals Corporation of America, 233 Broadway, New York 7, N. Y. **Circle 319**

Electronic Gaging

A complete description of electronic gaging systems and of each of the modules comprising them is given and typical applications are shown in a 12-page brochure. Radio Corp. of America, Industrial and Automation Div., 12605 Arnold Ave., Detroit 39, Mich.
Circle 320

Abrasive Wheels

Over 1600 experience-tested abrasive wheel recommendations for grinding everything from agate to zirconium are set up in alphabetical order in a 57-page, three-hole punched specifications catalog. Material, work, operation—with their respective recommendations on abrasive, grit, grade and bond—are listed for reference. Advertising Branch, The Carborundum Co., Niagara Falls, N. Y. **Circle 321**

Precision Ground Steels

Presented in this catalog is information on oil hardening-air hardening, low carbon, precision ground tool steels. Over 1000 sizes are listed. Tables or charts on thickness, widths and prices are shown. Descriptions of each of the steels are thoroughly detailed, along with proper uses and heat treat characteristics. Peninsular Steel Co., 24401 Groesbeck Hwy., P. O. Box 3853, Detroit 5, Mich. **Circle 322**

Carbide Tools

"Carbide and the Automatic Screw Machine" presents fundamental information on the use of carbide tools on steel with Brown & Sharpe automatic screw machines. The material is based on plant-conducted tests and covers turning, forming and cutoff operations. Brown & Sharpe Mfg. Co., Providence 1, R. I. **Circle 323**

Straight Side Presses

Illustrated bulletin 5-B details the recently modernized KRW straight side, single action, hydraulic press line, which has been expanded to include a range of 25 through 1000 tons. Features described and illustrated are: steel frames, angle gib guiding, adjustable hydraulic systems, constant speed and variable speed stroke arrangements, manual lever and electric pushbutton controls, and accessories. Specifications are included for all 48 models, with either up-acting or down-acting platens. K. R. Wilson, Inc., Arcade, N. Y.
Circle 324

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A Product of **BIJUR** LUBRICATING CORPORATION
Rochelle Park, New Jersey
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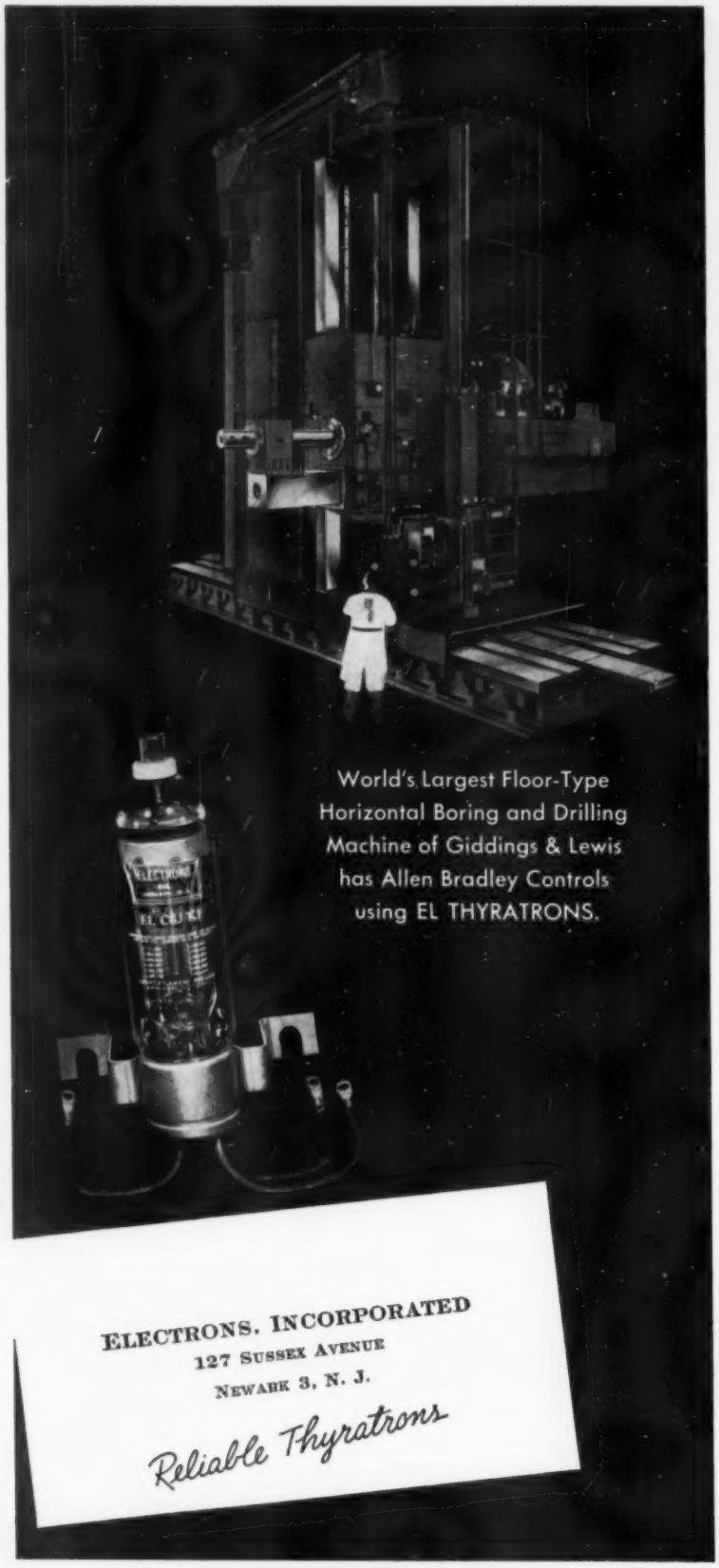

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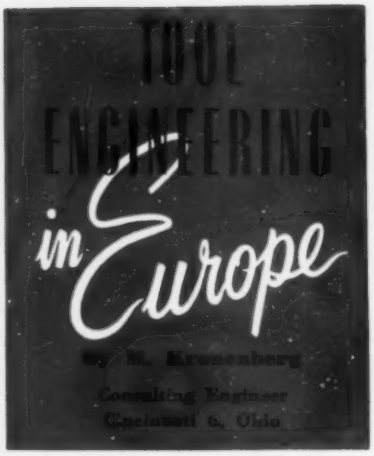


European Machine Tool Show

All European magazines on tool engineering devote a major portion of their September issues to the European Machine Tool Show in Paris. This show is held each year in a different country. *Werkstatt und Betrieb* has issued an edition (No. 9, 1959) dealing with the machine tool development by countries. H. Phillip reports on the West German machine tools at the Paris exhibition with 196 illustrations. In a report, supported by 78 illustrations, E. Saljes deals with the Swiss machine tools. Italian machine tools are described by M. Gorini.

The British machine tool sector at the exhibition in France is analyzed by A. K. Thomas, using 58 illustrations. P. Salomon reports on the French machine tools (17 illustrations). The Belgian machine tools are considered by R. Molle, the Austrian by R. Musyl and Dutch by Van Egeraat.

Each abstract has been printed in five languages—all in the same issue—namely, English, German, French, Italian and Spanish. Accuracy, profiling devices available, freedom from vibration, rigidity and metal removal rate programming are among the items most often mentioned by the various reporters as characterizing the progress made in the European machine tools.

While German and British machine tools are generally familiar to American tool engineers, it is the machine tools of the newcomers in this field who begin to play an important role in the industrialization of their respective nations. The machine tool industry in the Netherlands is very young, but has increased its export capacity by perhaps 400 percent during the past seven years. A contributing factor is the fact that American machine tools are being built in Holland.

The Austrian machine tool industry has also increased greatly, particularly in field of special machinery such as small, hand-operated milling machines and combination machine tools that can be used as lathes, milling machines, slotting machines or planers. A vertical crankshaft grinding machine, where the crankshaft is held between vertical axis centers, was exhibited by a Belgian machine tool company. A grinding machine for guideways of machine tools was among other special machinery exhibited by Belgian concerns.

The Italian machine tool industry claims development to be handicapped by shortage of electrical energy and difficulty in obtaining raw materials. Despite these limitations, the industrial growth of Italy is progressing. Huge horizontal boring mills are described in the Italian section of the September issue of *Werkstatt und Betrieb*, also grinding machines, radial drills, planers and other machines.

Thread grinding machines, and an automatic copying machine for milling operations, made in Great Britain, are outstanding. An overhead frame is used on the copying machine to give high rigidity. Turbine wheel gear milling machines were exhibited by a British machine tool manufacturer and also a precision gear cutter for gears up to 160 inches in diameter.

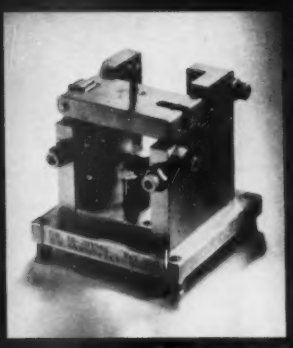
Rigid design in order to secure high precision is mentioned as the hallmark of the Swiss machine tool industry. The Swiss drive for accuracy was originally initiated by the requirements of watches and other precision instruments. Jig borers, first developed in Switzerland, were on exhibit at Paris.

The German machine tool industry occupied the greatest portion of the exhibition. In drilling machines, the spindle nose has been put back into the sleeve and left and right-hand rotation of the spindle is operated by pedal switching. In addition, the reversal of rotation can also be made automatic, controlled by cutting process itself. In case of hard spots or stringy chips, addition of this control is claimed to reduce twist drills breakage. Photoelectric coordinate control mechanisms are used on horizontal boring mills in addition to television sets attached to large machines which permit the operator to observe the machining process from a remote place.

Milling machine frames are being built on the principle of shell or frame design for increased rigidity. Preselection of speed, infinitely variable speeds are among the main features of modern milling machines.

Chipless forming machines, such as presses and similar equipment were likewise on exhibit in great numbers, employing stepped and infinitely ad-

Tooling with tape...



This drill jig: $280.00

This drill jig: $4.20

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The lowest-cost complete point-positioning system for drilling, tapping, reaming, spot facing

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Built to machine tool standards . . .
TO GIVE TOOL ROOM PRECISION . . .
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NEW
ENGELBERG
SERIES 96
ABRASIVE BELT
MACHINES

Write today for free catalog sheet containing complete information and specifications on the Engelberg Series 96 abrasive belt machines.

AVAILABLE WITH FROM ONE TO SIX OR MORE GRINDING HEADS

CAPACITIES:

6" x 96" Belt:
5½" max. width and
6½" max. thickness

9" x 96" Belt:
8½" max. width and
6½" max. thickness

12" x 96" Belt:
11½" max. width and
6½" max. thickness

OPTIONAL FEATURES:

Electro-Magnetic chucks
Powered elevation of grinding heads
Built-in coolant filtration system

From the leaders in the industry . . .

The new Series 96 Heavy Duty abrasive belt machines are built to deliver toolroom precision in continuous production runs.

High speed multiple grinding and finishing operations are performed in the same time required for a single operation. Rapid, exceptionally heavy stock removal permits unmachined surfaces to be ground to fine finishes and exacting tolerances in one continuous pass.

Heavier construction and solid, one-piece work table enable Series 96 machines to maintain tolerance standards of ± .0005 on flat finishing, with stock removal up to ⅛" per head on ferrous material.

Conveyorized feed is adjustable, ranging from 0′ to 67′ per minute. Both conveyor and abrasive belts feature pneumatic tensioning.

Rapid-traverse grinding heads are equipped with #50-taper hardened precision ground spindles, with super-precision taper roller bearings.

Representing the peak of development in abrasive belt machines, Series 96 take their place beside the finest of machine tools for speed, precision, reliability and cost reduction.

SUNDSTRAND-ENGELBERG

***Precision* Abrasive Belt Grinders**

SUNDSTRAND

SUNDSTRAND MACHINE TOOL
Division of SUNDSTRAND CORPORATION
BELVIDERE, ILLINOIS

justable drives, hydraulics and programming devices. Measuring instruments were on exhibit including a device for measuring roundness and accuracy of milling cutters for gears or profiles.

Shrinking of Welded Seams

An investigation was made by I. Bizinger at the Technical University of Budapest, Hungary, on the shrinking of weldments. The data were published in German as part of a booklet named *Periodica Polytechnica*, Vol. 3, No. 2, 1959, printed by the university.

The author differentiates between shrinkage in longitudinal, crosswise and angular direction. Several equations are discussed presented both by the author and earlier investigators. Tests made of shrinkage causes lead to the conclusion that all layers of the weld cause shrinkage, not only the first layer. The first layer, however, is responsible for the greatest shrinkage. Shrinkage is independent of whether a-c or d-c current is used. Bizinger also indicates the *v*-weldments have greater shrinkage than *x*-weldments. Automatic welding results in greater shrinkage than hand welding.

Mechanical Metallurgy

Three types of deformations are encountered in practice according to an article published by M. Kurrein in *Der Maschinenmarkt*, No. 45, June and July, 1959, under the title "Mechanische Metalurgie."

The shapes of workpieces can be changed in various ways; by stretching, drawing, rolling and machining. The microstructure, however, is differently affected by each method. The author reduces the possibilities to three basic deformations, termed "free deformation," "semifree deformation" and "forced deformation." In the first type of deformation the microstructure is free; the body is deformed under the influence of external forces. In the second case, the deformation is produced by a tool acting in a given direction; the opposition force is produced by the undeformed material. Microscopic structure in semifree. In the third case, the material takes the shape of the tool, for example, valleys on the tool become hills on the work and vice versa. The microstructure is "forced" in this case.

This theory is illustrated by numerous diagrams and photomicrographs covering such things as torsion, tension, compression, metal cutting and metal shearing. Tool engineers will be interested to learn that the dispute—which is 80 years old—comes up again as to whether the metal shears in a machining process or whether it ruptures.

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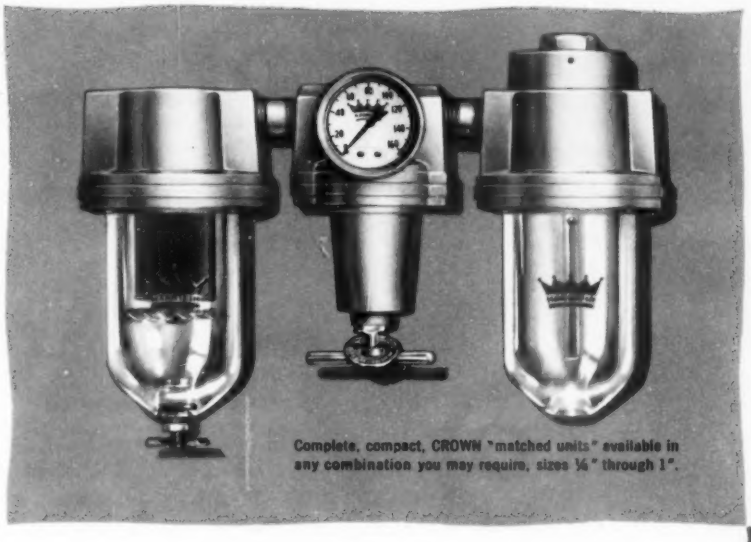
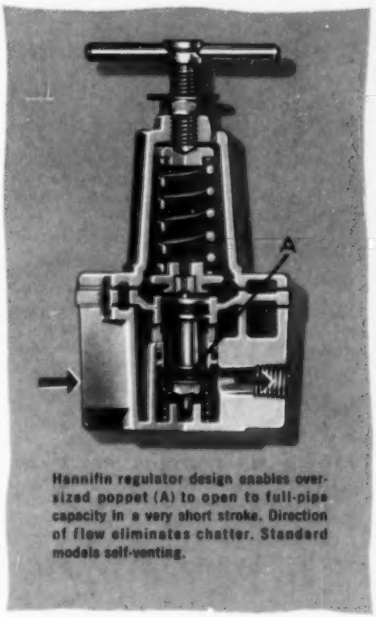
USE READER SERVICE CARD, CIRCLE 99

Crown From HANNIFIN air preparation units that don't waste air power



Complete, compact, CROWN "matched units" available in any combination you may require, sizes ¼" through 1".



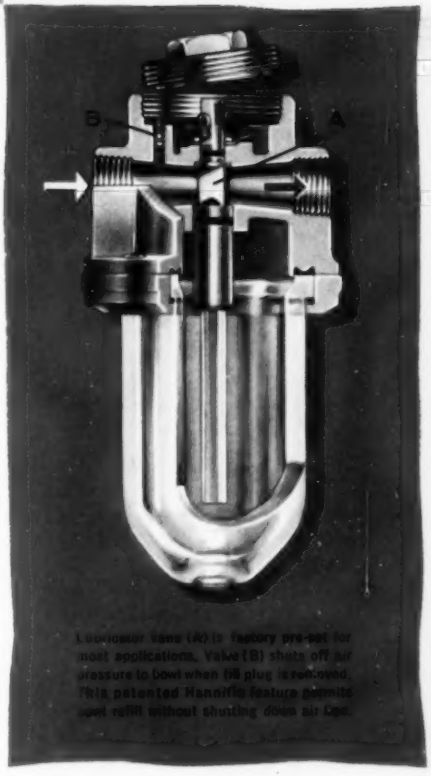
Hannifin regulator design enables oversized poppet (A) to open to full-pipe capacity in a very short stroke. Direction of flow eliminates chatter. Standard models self-venting.

Hannifin CROWN "Combo" units – filters, regulators and lubricators in any combination – keep compressed air in the "pink of condition" without depriving you of needed air flow.

Crown regulators open fast on demand, close precisely when demand is satisfied, deliver the exact amount of air needed. Their "piston balanced" poppet design, which makes possible a flat, large-area, poppet-type valve with very short stroke, is the reason. The inherent stability of this design – no hunting or chatter – results in multi-million cycle life.

Crown filters have large, reusable filter elements for minimum resistance to air flow. Crown lubricators introduce predetermined amounts of oil into the air stream, automatically. Their design is so responsive to variations in air flow rate that the concealed, tamperproof adjustment is rarely used. This is the easiest lubricator of all to fill, and remote-fill models are available.

Crown units are competitively priced and stocked in principal industrial areas by Hannifin CROWN authorized distributors. For CROWN literature and the name of the distributor nearest you, write:



Lubricator bowl (A) is factory pre-set for most applications. Valve (B) shuts off air pressure to bowl when fill plug is removed. This patented Hannifin feature permits bowl refill without shutting down air line.

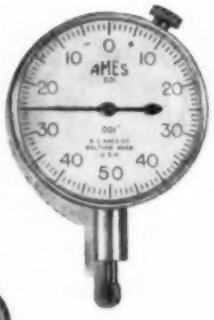
HANNIFIN COMPANY

535 South Wolf Road • Des Plaines, Illinois

PORTA-CHECK®
A transistorized portable comparator for fast accurate measurement in both "tenths" and "thousandths" scales.

MODEL AG AIR GAUGE
For checking diameters, dimensions, roundness, etc.

200 SERIES MICROMETER DIAL INDICATOR
One of four sizes. Made to AGD specifications.



NO. 2 DIAL COMPARATOR
For desk, bench or at-the-machine inspection of small parts.

AMES

Masters of Measurement...

For more than half a century, Ames measuring instruments have been regarded as the finest made. Today the constantly growing line of Ames indicators, gauges, micrometers and comparators includes such amazingly accurate instruments as the new Ames "PORTA-CHECK", an electronic comparator which gives accurate readings *in millionths of an inch*; and the new Model AG air gauge—also accurate to millionths of an inch. Wherever precision is *really* important . . . you'll find Ames "masters of measurement" on the job.

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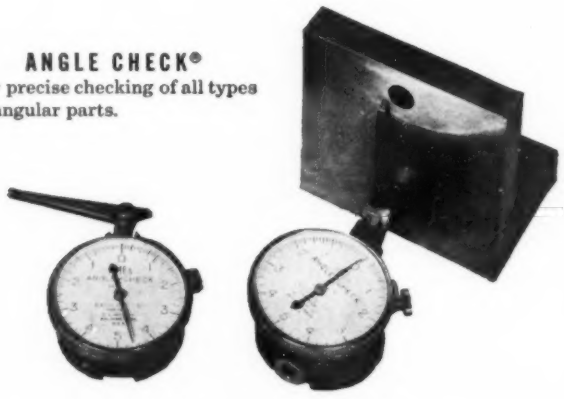
MANUFACTURERS OF MICROMETER DIAL INDICATORS AND GAUGES

ANGLE CHECK®
For precise checking of all types of angular parts.



technical shorts

Crush Grinding Plastics Parts

Crush form grinding has applications in forming small cylindrical parts from laminated plastic or vulcanized fiber. Adaptation of conventional centerless grinding results in as much as 20 percent faster production than screw machine or lathe methods and in some instances enables the operator to hold tighter tolerances. An additional advantage of crush grinding is that it leaves no burrs.

Capable of producing any part which can be produced on a lathe with forming tools, crush grinding is recommended where finish tolerances must be held to ±0.005 in. or tighter (normal screw machine or lathe tolerance is ±0.002 in.); where parts are required in large enough quantities—generally 300,000 and upwards—to justify initial cost of wheels; and where lathe bits might cause delamination of the laminated plastic.

Typical parts formed by Taylor Fibre Co. have included reels, bobbins, ball bearings, small pins with tapered ends and shafts. A recent case illustrates the value of the technique. In this instance, the part required was a firing pin, only 0.225 in. long, 0.064 in. wide, and with tolerance of ±0.005 in., with no burrs permitted. Requiring a 15-deg taper at either end, to 0.020-in. depth, this part could not have been made by other production methods and still have met tolerance requirements.

* * *

X-Ray Diffraction For Quality Control

X-ray diffraction will be used for production line quality control within the next two to three years, according to Dr. David Harker, Polytechnic Institute of Brooklyn.

Speaking at the X-ray diffraction school sponsored by General Electric Co., Dr. Harker predicted that the role of X-ray diffraction in metalworking is certain to be enlarged.

A beam of X-rays, focused on a specimen of any substance, is diffused according to the atomic structure of the specimen. If the specimen is crystalline, its atoms are stacked up within it in an orderly manner. The X-rays scattered by the atoms cancel each other except in certain directions. These diffracted X-rays can be recorded on a sensitized film as a diffraction pattern.

Because each arrangement of atoms produces its own characteristic pattern, the pattern can be interpreted to detect changes in metals while they are being worked or heat-treated.

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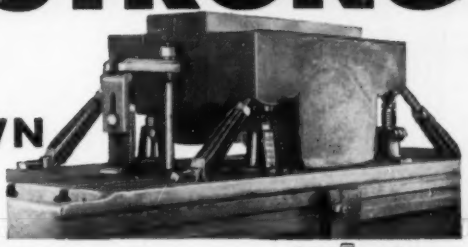

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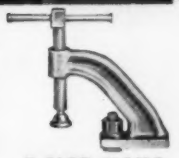

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Magnetic Holding Fixtures

Tech Digests

By Frank L. Suchenek
Sales Manager
Sunstrand Machine Tool Co.
Rockford, Ill.

ALTHOUGH MAGNETIC CHUCKS have been useful accessories to various machine tools for over sixty years, they have recently taken on new stature as a means for clamping. The electromagnet provides the tool engineer with control of magnetic forces and fewer limitations in his fixture design. It is also a simple matter to provide safety interlocks so that the machine cycle will not start or feed unless the holding forced has been applied and is fully effective.

The first factor considered when magnetic clamping is proposed as a production tool is the saving of time and effort on the part of the operator. This, of course, is paramount on any job if a high level of productivity is to be maintained. Tracing motions required for part clamping by means of lights on operator's wrists reveals considerable savings in time and effort is obtainable by using magnets. When faced with a production problem in which loading time is greatly in excess of cutting time, a magnet may be the answer.

Milling machines have been constructed equipped with a heavy-duty trunnion fixture which includes a magnetic chuck 12 feet long for the producers of heavy shear knives. *Fig.* 1 shows a 50-hp mill equipped with this fixture which cuts loading and clamping time by 75 percent, as compared to the time previously required with mechanical clamps.

The user of this machine also reports greatly improved cutter life as well as an increase in speeds and rate of feed. This is an important benefit derived from magnetic holding which should be carefully considered. When a piece part is clamped by magnetic force, theoretically, every molecule of ferrous material throughout the workpiece is influenced by magnetism. The holding forces are uniformly distributed throughout the piece part. This uniform distribution of holding force means less vibration in the piece part, which sharply reduces chatter as compared to nonuniform or intermittent holding by clamps. This results in improved cutter life.

To further take advantage of the magnetic holding force, designers should strive to take the thrust from the table feed and the cutter against a mechanical stop which is not attached to the magnet frame. By arranging a fixture in this manner, it permits the magnet to function more effectively as a registering device wtih a maximum of rigidity.

In another production problem a magnet eliminated an accuracy problem and improved loading and clamping time. A combination magnetic and mechanical fixture is used to do all the operations on a transmission housing. Magnetic holding is available in both horizontal and vertical planes and the part is milled on a special Triplex Rigidmil. The job was originally held with four tunnel type mechanical clamping fixtures. The heavy clamping pressures necessary to properly hold the piece caused it to distort. When clamping pressure was released, the top and ends of the housing were not flat within required limits.

An ideal holding arrangement was achieved by locating this housing by two dowels in the horizontal magnet and then adjusting the vertical magnet until it registered against the side surface. Distortion was no longer a problem and parts were milled within 0.0005 in. tir for parallelism. This is excellent for parts of this size.

Small parts have always been a problem to hold satisfactorily on a magnet. This is due to the fact that holding power is proportional to the

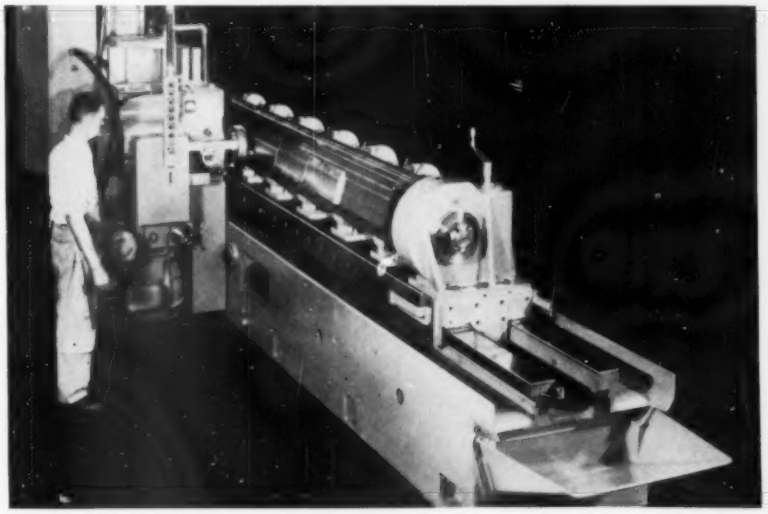

Fig. 1. A 12-foot magnetic trunnion fixture on a 50-hp Rigidmil.

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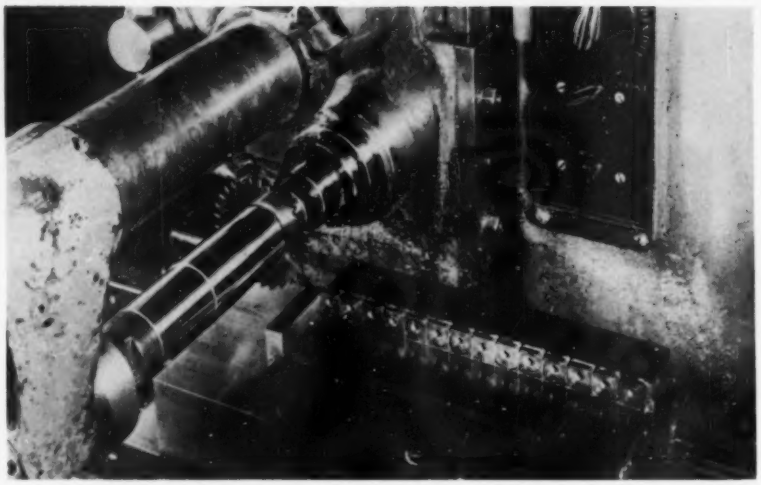

Fig. 2. Slotting 14 small parts on a special magnetic fixture.

mass of the piece part. *Fig.* 2 shows a small part measuring $\frac{5}{8}$ x $\frac{5}{8}$ x $\frac{5}{16}$ inch through which it was necessary to cut a slot 0.090 inch wide and $\frac{1}{2}$ inch deep. The part was originally held in a vise which did not grip the part properly and frequently pinched the slotting cutter. By proper arrangement of the magnetic poles so that the holding force was directed through one side and bottom surface of the part, a maximum of tractive force was achieved. The fixture handles 14 parts per load with a feed rate of 13 ipm. Even though 23 percent of the total mass of the part was removed in this slotting cut, the parts were properly held and cutter life between sharpenings averaged 30,000 parts or approximately 2140 cycles.

In another instance, another small part was almost impossible to clamp properly and meet production requirements. This piece is a refrigerator valve plate, a meehanite casting that is $\frac{3}{8}$ inch thick, $2\frac{1}{2}$ inches wide and 2 inches high. Both sides of the part were face milled in a reciprocating milling cycle; the operator loaded one fixture while the other was in the cut. Control of the magnetic fixture is through trip dogs on the table which activate limit

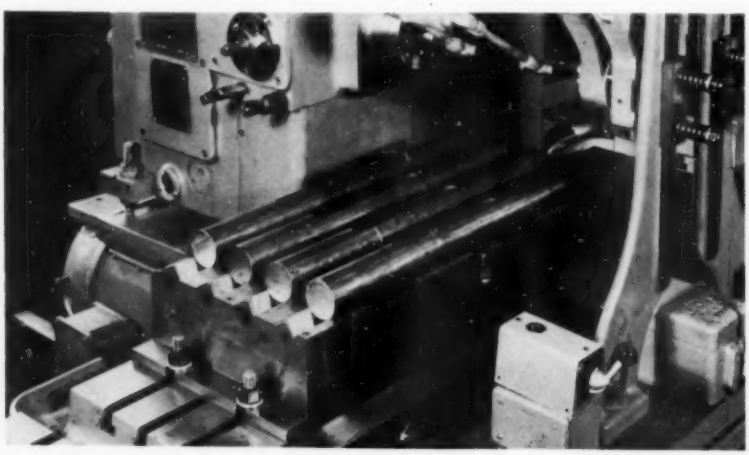

Fig. 3. Keyway milling various shafts on magnetic vee fixturing.

switches. Two transformer-rectifier units were used so that control of each fixture was independent of the other. Production averaged 170 per hour at 85 percent efficiency.

Milling keyways in various shaft sizes and holding them in magnetic vee fixtures is another popular application for this holding method. In *Fig.* 3 the cutter and arbor have been removed to provide an unobstructed view of the complete fixture. No clamps are used whatsoever. The operator lays the shaft in the vee and registers it against the end stop which is mounted on the machine table. Keyway cuts are made by climb milling with automatic rise and fall movement of the head. The vee fixtures have flame-hardened surfaces and are finished as matched sets. These fixtures are attached to standard magnets which are wired in parallel. The vee fixtures can be easily removed and another set attached to accommodate various diameter shafting.

TO REQUEST COMPLETE PAPERS WRITE TO THE ADDRESS AND ORGANIZATION INDICATED AT THE END OF EACH ABSTRACT

Savings are realized in this type of tooling in several ways; first a smaller diameter cutter can be used since no clearance over mechanical clamps is required; second, the shafts can be grouped closely together so that more parts per machine cycle can be handled on a machine of a given width. To cite an example, the machine in *Fig.* 3 has a 10-inch table; four 1¾-inch diameter shafts are easily held. Savings are also to be expected in improved cutter life and higher production with less operator effort.

Rotary chucks receive their electrical supply through the use of collector rings and brushes. A compound arrangement of brushes is preferred with two pairs of brushes in parallel to insure the d-c supply. A production lathe fitted with a rotary chuck is used for various facing and boring cuts on a clutch plate. Direct current is supplied to the magnet by a collector-ring brush assembly mounted at the rear of the headstock spindle. The wiring is through the spindle in conduit to the center of the magnet.

Initial cost of the magnetic fixturing compares favorably with hydraulic or air clamping fixtures, but savings in operator effort, accuracy in production and improved tool life combine for definite economic advantage.

There are many places for magnets in improving the productivity of machine tools; for example, they can be very useful in handling parts automatically in loading and unloading machines. They can be used to advantage as accessories to conveyors and other special applications. It is important also to observe that maintenance and operating personnel become familiar with magnetic equipment and soon learn to get the most out of it. It can be a powerful, versatile piece of equipment when applied properly.

Based on a paper presented at the 23rd Annual Machine Tool Electrification Forum, sponsored by the Westinghouse Electric Corp., Buffalo, N. Y.

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By J. J. Rheinhold
Vice President
Richardson-Allen Corp.
College Point, N. Y.

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Based on a paper presented at the Design Engineering Conference of the American Society of Mechanical Engineers, 29 W. 39th St., New York 18, N. Y.

▼ ▼ ▼

Formulating Product Requirements

Dudley E. Chambers

Manager
Engineering Services Research
General Electric Co.
Schenectady, N. Y.

For many business enterprise today which looks forward to continuing competitive progress, growth, and profit, one problem is apt to be particularly outstanding. This, in a nutshell, is the problem of how best to pin down and express the various business opportunities as facing the enterprise at any given time, in terms of the specifications, or specific requirements, to be met by its products and services. Indeed, in the present dynamic technological climate, this is a problem which increasingly goes to the very heart of business strategy.

Moreover, there are particular complications here when the problem is considered in the light of what it is the product engineer should be expected to contribute.

While some of the product engineer's contributions along these lines may be fairly obvious, it also may be that it is precisely this that obscures the possibilities with respect to still other contributions which he can, and should, make—and which will be of equal, if not even greater, importance.

In any event, experience suggests that it is all too easy to take a relatively short or near-sighted view of what is involved here—a view which when adopted by product engineers, for instance—leads straight into these pitfalls:

1. Preoccupation with the design problems involved in exploiting present products
2. Exclusive concentration on the qualities of the products
3. Design "optimization" which overlooks or ignores important manufacturing and marketing-cost elements inherent in design.

4. Failure to seek out and take advantage of opportunities to provide for doing research and engineering work in advance of immediate customer or market need, or, especially in the diversified company, on a pooled basis.

Yet experience also suggests that all of these pitfalls can be avoided if, from the outset, engineering managers supply —and product engineers keep in front of themselves—a clear picture of the nature of the problem today, and of what should be considered and included under product requirements. As the discussion which follows will seek to suggest, the adoption of certain viewing points here can be particularly useful in constructing a picture which focuses on the key challenges involved.

To bring the first of these challenges into the spotlight, then, a good point of departure is in the fact that in ever increasing numbers, business enterprises are having to recognize that fundamental changes are occurring in the competitive environment they face. And one way of pointing this up is to recall that in our private enterprise system, historically the business enterprise has been founded on the determination of an opportunity to serve via products or services; and that, basically, such an enterprise comes into being in one of two ways. It may get its start from the recognition that an attractive business opportunity exists with respect to a certain existing or potential customer need or want which has yet to be filled. It may get its start because its founders recognize that they possess, or are in a special position to obtain or develop, the capabilities necessary to do something which heretofore hasn't been done—or which hasn't been done well; and because the exploitation of these capabilities in the market place offers an attractive opportunity.

From both sources, new business enterprises continue to spring into being today. Yet the point requiring emphasis here is that while a good start may have been the most vital element in the business success story of but a few decades ago, now on the other hand such success is less and less a matter of simply exploiting the business opportunity as originally perceived. Clearly, in the present dynamic technological climate, the continuing prosperity and growth of the enterprise may well require a continuous flow of ideas with respect to additional opportunities to serve—which opportunities again may be based on unfilled customer needs and wants, or on the ability to do something new or different for the customer.

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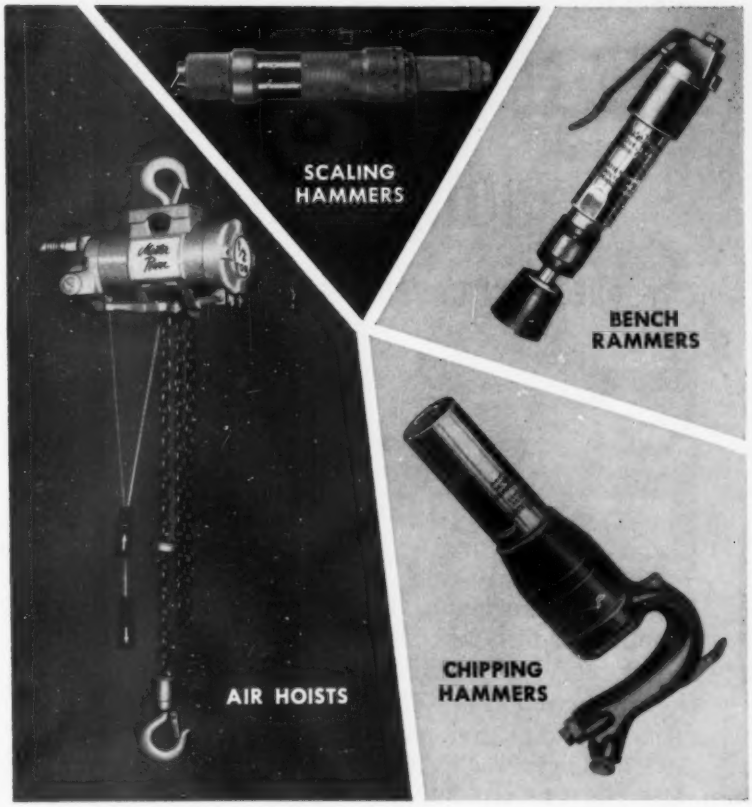

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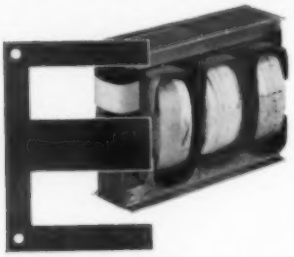

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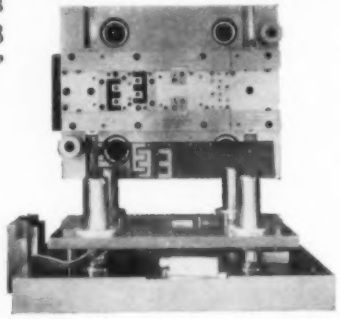

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It is apparent that it is particularly in the latter area that the product engineer should be expected to contribute; but it is important to see that the challenge presented here is a double-barreled one.

There is, first, the challenge to make an increasingly vital contribution to the overall business strategy of the enterprise, that is, to be continually on the alert for and to recognize the current scientific and technological developments, and the current trends in developments, which for the business or industry in question increase the competitive pressures for new ideas, and on this basis, then, to make suggestions regarding the necessary emphasis to be placed on the research and engineering effort aimed at innovation.

There is also the challenge actually to come up with the needed ideas and innovations. Of course, it should be kept in mind that this increasing challenge to innovate is not addressed to the product engineer alone; important contributions, for instance, can be expected from people in marketing.

Similarly, if there is in view an opportunity to serve based on the enterprise's presumed engineering or manufacturing abilities to do something for the customer or market, it can be a good idea to check with the experts in the marketing areas of the business to see whether in fact the customer or market needs or wants to utilize that ability.

But, beyond this, if the opportunities which look good in the light of such screening are to be realized, they must be expressed in terms of requirements for products and services—which, to the product engineer among others, presents additional important challenges.

In the first place, a good many product engineers face a need to take a more searching look at what these product requirements involve, and to raise their sights in terms of what their contributions can be to the formulation of such requirements. And for this purpose, it is necessary to recognize that the primary viewing point employed should be that of the customer or market, and that the product requirements in question are those for the product as it will be designed, produced and marketed.

Hence, from this point of view, product (or service) requirements include much more than the price of the product, plus the product qualities; that is its qualities of performance, features, and attractiveness.

At the same time, there is a challenge to make additional important contributions here which comes into view when the picture of what is involved in formulating product requirements is extended to include the following point:

Between what the customer or market would view as the ideal requirements and those which the enterprise establishes as the requirements it indeed will face and meet, there will not necessarily be a perfect match—and the nature of the gap depends on the enterprise's business strategy.

Now, in the case of product engineering, this challenge to integrate means, for one thing, that the product engineer must take into account the strategy and capabilities of the manufacturing function. To considerations of performance, for example, he must add considerations of producibility; and in making his contributions to formulating the product requirements to be faced and met by the enterprise, he should have in mind the possibilities with respect to design contributions to producibility.

TO REQUEST COMPLETE PAPERS WRITE TO THE ADDRESS AND ORGANIZATION INDICATED AT THE END OF EACH ABSTRACT

Likewise, the product engineer must take into account the strategy and capabilities of the marketing function, and, in making his contributions to formulating the product requirements to be faced and met by the enterprise, have in mind, for example, the possibilities with respect to design contributions to marketability.

Finally, there is a challenge to make still other important contributions to the formulation of product requirements which comes into view via these points:

That the effectiveness of the enterprise's longer-term strategy depends on providing for readiness to serve in advance of customer or market need—plus, especially in the diversified company, making optimum use of opportunities to undertake pooled effort. Also, that this necessitates the formulation of requirements which hold true for the longer term, or which have across-the-board applicability—for example, the formulation of common-denominator or longer-term requirements relating to the business as a whole, or for aggregates of products.

Based on a paper contributed by the Management Div., and presented at the Semiannual Meeting of the American Society of Mechanical Engineers, 29 W. 39th St., New York 18, N. Y.

New Developments in Metals and Ceramics for High Temperature Service (Above 1000 F)

By Julius J. Harwood

Head, Metallurgy Branch
Office of Naval Research
Washington, D. C.

Changing requirements for materials for high-temperature operation have brought about different approaches and emphasis in the development of new types of high-temperature materials. Thermal properties of materials, refractory metals, thermal-protection systems and composite materials have assumed significant roles in the current materials-development picture.

Certainly, many difficult obstacles must be overcome to satisfy the insatiable demands for materials for high-temperature service. Weldability and fabricability of high-strength materials appear to be particularly important problem areas. Less ductile materials than we ordinarily have been accustomed to are necessarily involved. There will certainly be no materials Utopia—indeed, insome respects we are approaching definite limits of materials capabilities. However, research and development programs now under way on refractory metals, fine particle strengthening, whiskers, ductile ceramics, composite materials, and fabrication and procesing techniques will most certainly lead to major improvements and to the introduction of completely new types of structural materials.

In order to guide future research, there is a critical need for more definite information concerning anticipated environments, design criteria, and operating conditions of future high-temperature systems and a more definitive interpretation of such environments and operations in terms of materials parameters. Our ability to take advantage of specific properties of materials and to develop combinations of materials, and the growing recognition that materials, environment, and design must be considered as an integrated system will lead to practical solutions to the many high-temperature problems created by rapidly advancing technology.

Based on a paper presented at the Design Engineering Conference of the American Society of Mechanical Engineers, 29 W. 39th St., New York 18, N. Y.

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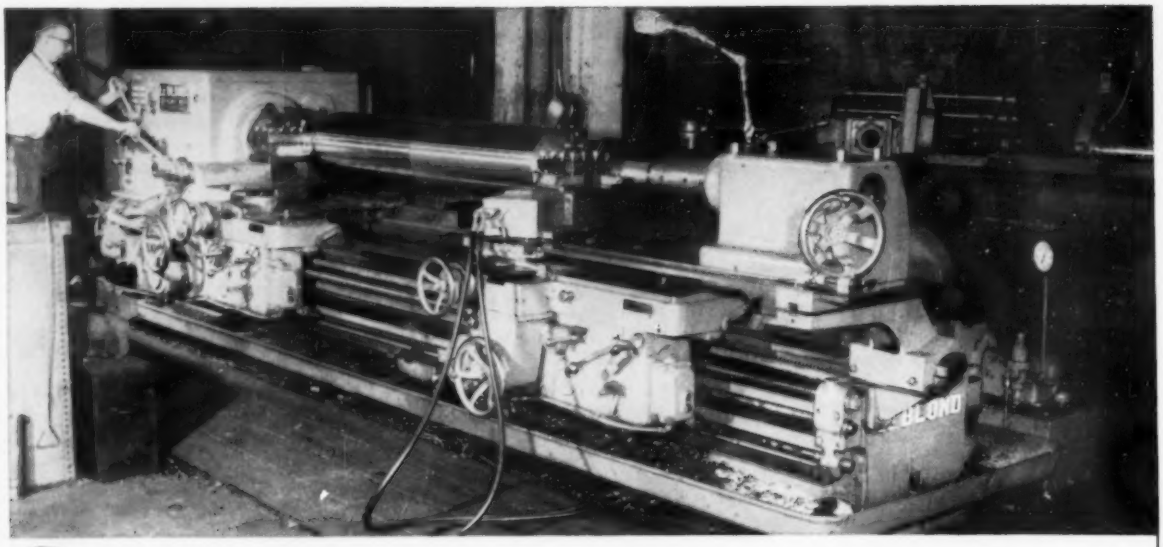

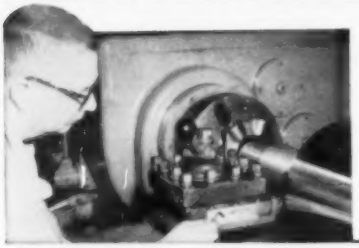

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Ask your Kennametal Carbide Engineer how other companies are relieving the squeeze on profits by sacrificing pennies in tool life for top machine output. Ask him how your shop may get more work out of present machines at less cost. Or write KENNAMETAL INC., Latrobe, Pa., for the full story . . . ask for the booklet, "There's Profit in Retiring a Tradition."

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CHECK THE SAVINGS POSSIBILITIES IN YOUR OPERATIONS

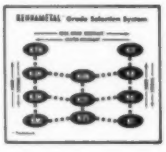
Jot down costs of throw-away inserts and output of one of your present machines . . . then in the next column the same data when insert life is reduced to 20, 30 or 40 minutes. The cost of inserts will multiply . . . but look what happens to over-all cost-per-piece and profit!

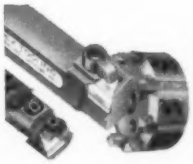
	Setup to get longest possible tool life	Full-capacity setup (for highest machine efficiency and output)
Machine cost per hour		
Tool cost per hour		
Total per 8-hour shift		
Pieces run per shift		
COST PER PIECE		

TO MULTIPLY YOUR MACHINE OUTPUT . . . YOU NEED THREE THINGS:

1. The "Three-Man Tooling Team" that utilizes the specialized knowledge of your Tool Engineer, your Machine Operator, and the Kennametal Carbide Engineer . . . *to determine the right tooling.*

2. The Kennametal complete range of Grades that provides the precise properties and uniformity that *permits accurate prediction of tool life.*





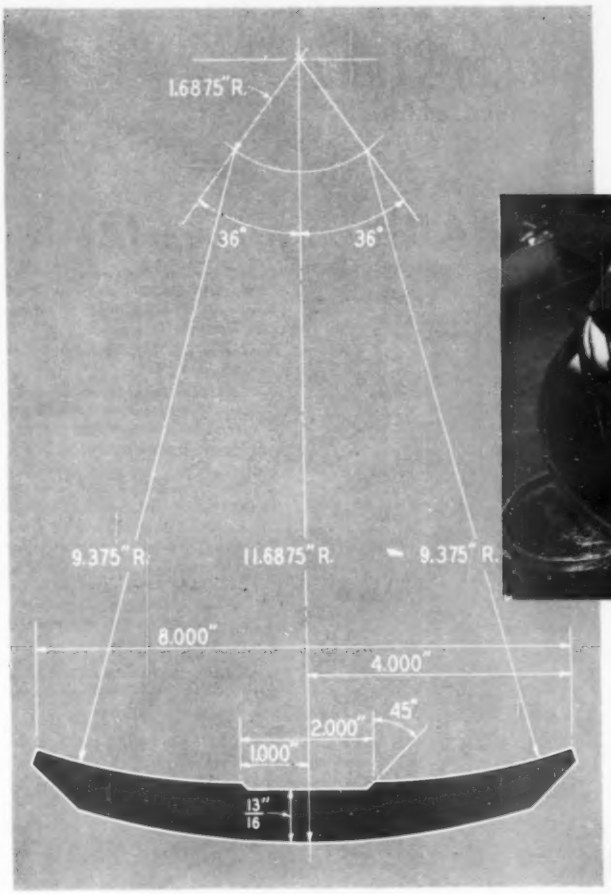
3. Kendex* (patented) instant insert change without need to reposition the tool. This is the key to this new practice . . . *frequent tool change without excessive downtime.*

5785

Don't waste $$$ in machine output to save ¢¢¢ in longer tool life

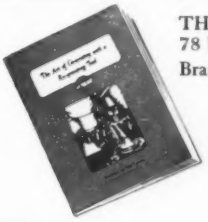
INDUSTRY AND **KENNAMETAL**

. . . Partners in Progress



2 RADII, 3 SURFACES Cut in One Operation

Difficult machining job? Shop management at Blanchard Machine Company, Cambridge, Mass., made it a simple production operation using a standard Fellows Gear Shaper. Eight of these segments are shaped at one time, as shown in the photograph. A special gear shaper cutter generates all of the internal surfaces in one revolution of the work table. The segments are then simply cut apart, drilled and tapped. The pieces are segment clamps to hold grinding wheel sections in the chuck of the Blanchard Surface Grinder. The same Fellows Gear Shaper, using appropriate cutters, can produce an almost infinite range of non-circular shapes, simple or complex, as well as internal and external spur, helical and herringbone gears, and gears close to shoulders or in recesses. The advantages of the Gear Shaper are illustrated in "The Art of Generating with a Reciprocating Tool." If you would like a copy just write us.



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Branch Offices:
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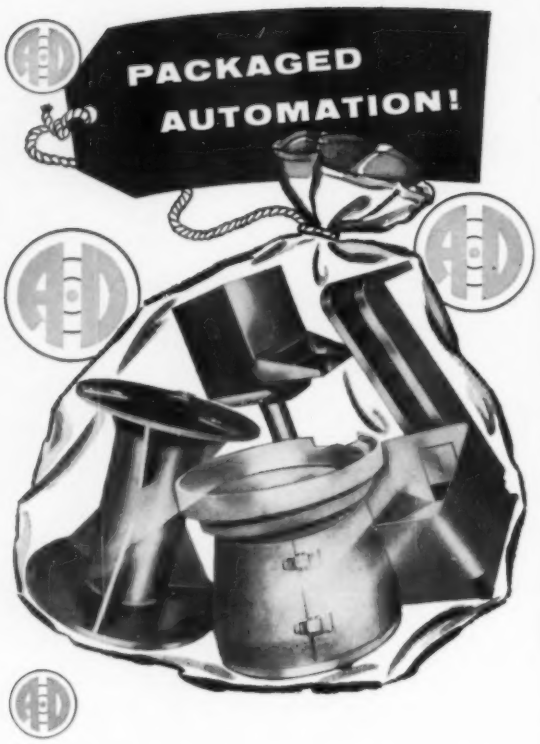
THE PRECISION LINE

Fellows *Gear Production Equipment*

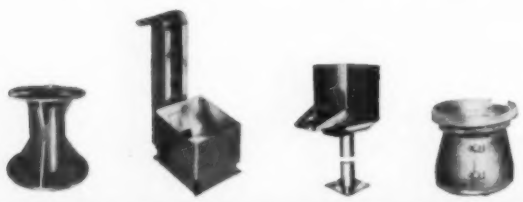


Achieve efficient, automatic production, and produce more all along the line, by integrating equipment designed and built by AUTOMATION for automation.

For example, vibratory parts feeders perform more efficiently on an engineered base permitting maximum power transmission. Either the side delivery or the elevating conveyor supply hoppers (with automatic paddle type relay switch to regulate delivery) hold large quantities of parts and are real labor savers. These are just a few advantages that make automation work and pay for itself.

You can depend on the proven talents at AUTOMATION DEVICES, INC.—enlist their help. Write today for the informative bulletin on "Packaged Automation."

PEECO & VFC DIVISIONS ... *TWO GREAT NAMES IN PARTS FEEDING*



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ERIE, PENNSYLVANIA

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HOGGSON BRAND

Les-Strain
rounded face
steel
stamps

MARK but don't **MAR!**

Order from this handy chart:	
Gothic style	*size (inches)*
A	1/16
A	3/32
A	1/8
A	5/32
A	3/16
A	1/4
A	3/8

On all the new lightweight metals HOGGSON BRAND Les-Strain steel stamps are the safest means of permanent identification . . . .

fracture is held to an absolute minimum

rounded faces of the character indent, but do not cut or crack the metal under normal use

HOGGSON BRAND Les-Strain stamps are:

manufactured of high strength alloy steel

designed with chamfered front edges to assure correct position for marking

available from stock in sizes shown, in sets of 27 letters and 9 numerals, packed in sturdy wood compartment boxes.

Insist on HOGGSON BRAND for the finest marking stamps. See your distributor. Send for our catalog!

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do jobs in minutes instead of hours

Cerro (bismuth-lead-tin-cadmium) *Alloys* are extensively used in many diversified industrial operations. *Cerro Alloys* melt at low temperatures and several tend to expand as they harden. They are easy to work with, neat, strong, versatile, can be remelted and reused over and over again. Used in design and development work and to improve products and simplify processes, these efficient, economical alloys save time, lower costs and increase profits. Various combinations of alloys are available, many "custom-blended" to fit your exact needs.

CDP

To learn more about CERRO ALLOYS and their wide range of applications, send for our new, illustrated "HOW TO" (No. J4) booklet.

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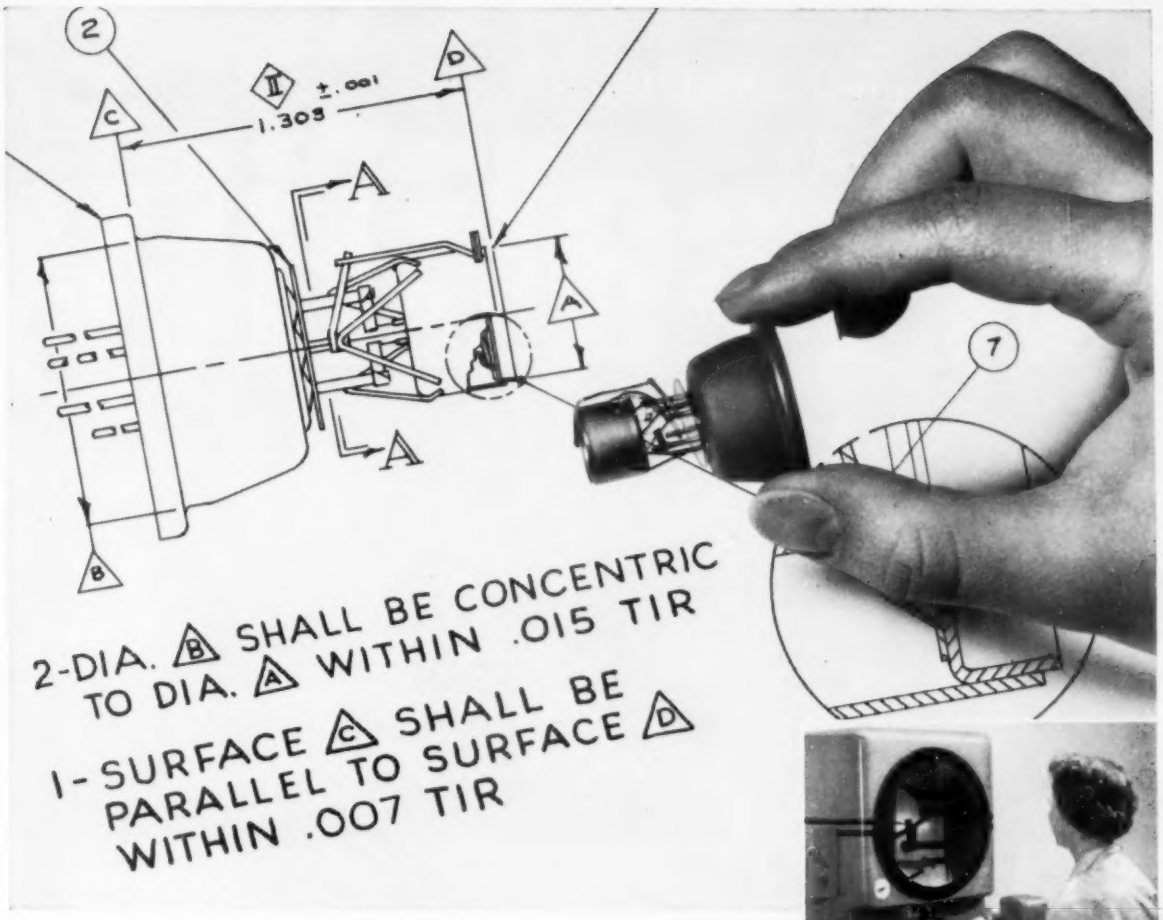

"We can cut out up to 20 gaging operations on delicate parts like this."

"Many times, with a single chart and fixture on our Kodak Contour Projector, we can quickly inspect several complex part dimensions at a single pass. This cuts gaging operations and costs to a fraction of the cost of separate gaging checks," says Varian Associates of Palo Alto, Calif., makers of precision electronic parts and equipment.

No contamination of or pressure on delicate parts (a light beam exerts no pressure, causes no wear); high-speed, accurate inspection of close-tolerance dimensions; few mechanical operations . . . these are only some of the reasons why manufacturers like Varian find optical gaging with the Kodak Contour Projector the most practical solution to many inspection problems.

You get more with a Kodak Contour Projector. You get greater *working distance*—8" of clearance for parts and fixtures. Especially important at high magnifications.

You get more brilliant, more uniform *illumination* over the entire screen area—at all magnifications.

You get highly *accurate images* even at the critical outer edges of the screen area.

You get *upright images* of all inspected parts for easier reference.

These and other features of the Kodak instrument make it more efficient and more valuable to you. Read about them by writing for the booklet, "Kodak Contour Projectors."

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THE KODAK CONTOUR PROJECTOR

Kodak

Complete DRILLING

versatility

for the "cumbersome" parts... with U. S. DRILL HEADS

- ☐ Full ball bearing mounting of shafts
- ☐ Shaved gears throughout
- ☐ Exclusive quick-change neoprene-sealed universal joints
- ☐ Heavy duty spindle assemblies
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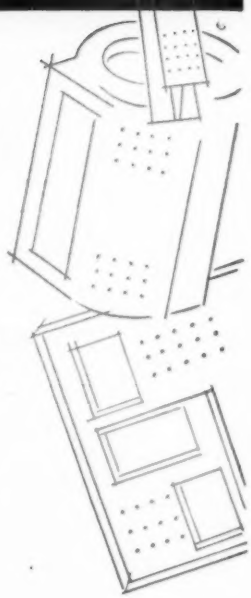
- ☐ Oil-tight, high-strength cast housings

Is your drilling *accurate and economical* in structural steel, tube sheets, flue sheets, and other large, cumbersome parts? It will pay you to check into a U. S. Drill Head installation on your radial drill!

Style U Universal Joint Adjustable Heads equipped with Air Counterbalance and 360° Ball Bearing Swivel Attachment give added versatility to any radial drill. Quick setup with positive lock of swivel in aligned position. Fast and accurate operation with minimum operator fatigue.

Select the *right* head for your jobs from the many sizes of Style U Heads. You'll get lots of cost-reducing features.

Write for descriptive literature, or ask for recommendations on your particular multiple drilling problems.



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Adjustable and Fixed Center Multiple Drilling Heads.
Individual Lead Screw Multiple Tapping Heads.

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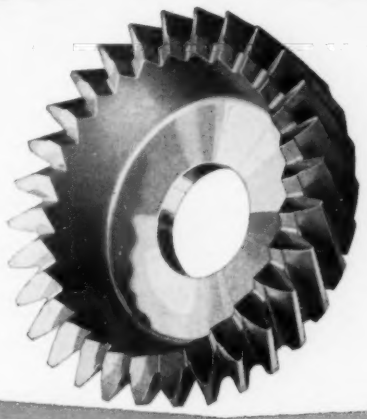
Everybody knows that
National Tool Company
makes gear shapers—



But did you know
we make rotary
shaving cutters...

and more special cutting tools of all kinds
than any other tool manufacturer?

For more than half a century National Tool Company has supplied high quality precision cutting tools to the metal working industry. When your job requires special cutting tools call your National Tool representative. His assistance is yours for the asking whether you're interested in one *special* tool or a complete tooling program.

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Please send NEW 92 page catalog showing National Tool Company's complete line of *special* tools for the metal-working industry.

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OVER 50 YEARS CLEANING EXPERIENCE • OVER 250 FIELD SERVICE MEN • OVER 160 MATERIALS

PLANT maintenance costs less when it's PLANNED maintenance

No doubt about it—clean surroundings help maintain employee morale and efficiency, boost production, reduce accidents. But, of course, all of this costs money. That's why it will pay you to ask Oakite about a Planned Maintenance Program designed especially to keep housekeeping expenditures low. Your Oakite man will be happy to help you develop a cost-cutting program on such jobs as cleaning and sanitizing locker rooms, cleaning floors, walls, ceilings, machinery, lighting fixtures and hundreds of other items that require routine maintenance. Here are a few sample Oakite plant maintenance procedures that have saved money for hundreds of satisfied plant maintenance men.

Heavy equipment:—such as Fork Lifting Trucks. Steam-detergent cleaning using the Oakite Hurriclean Gun.

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Ask the Oakite man to help you draw up a Planned Maintenance Program and watch your routine maintenance costs go down. Meanwhile, send for this informative bulletin which gives details on plant-wide maintenance. Oakite Products, Inc., 26 Rector Street, New York 6, N. Y.

it PAYS to ask Oakite

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years' leadership in industrial cleaning

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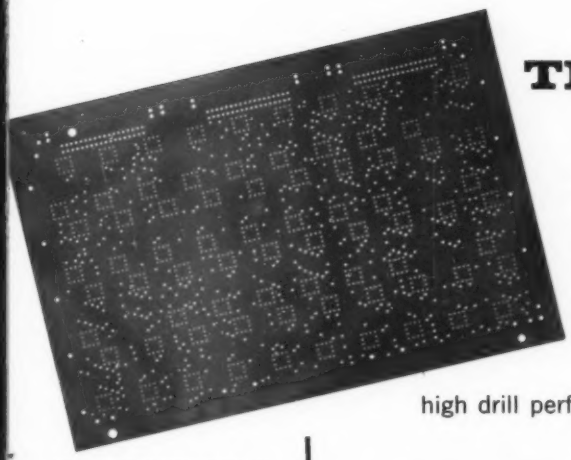

On some plates such as this one, up to 1014 holes are drilled on one pass!

The odds are 579 to 1

Those are the odds on each drill in this setup at Burroughs Corporation's Tireman Plant in Detroit. When a 3/32" circuitry panel of Epoxy glass, copper clad .0014" both sides, contacts these 580 "Greenfield-Ampco" drills, failure of any one drill would offset the efficiency of the other 579 on that pass. And each pass carries the same odds! So a job like this demands not only high drill performance, but highly uniform performance as well.

GREENFIELD TAP & DIE

GREENFIELD, MASSACHUSETTS

BUY FROM YOUR GREENFIELD DISTRIBUTOR FOR SERVICE AND QUALITY

CLASS 3 THREADS WITH HORTON CHUCK!

What do we mean, talking about chucks and class 3 threads in the same breath? Just this: unless the work is held concentrically and runs true, that die head which is the best there is for the job (Geometric, of course) cannot compensate for excessive "run out" in the chuck.

That's why you need precision chucks, for precision threading.

Running class three threads? Better check your chucks, "Chuck" out worn out chucks, and, replace them with new HORTONS.

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GEOMETRIC-HORTON, NEW HAVEN 15, CONNECTICUT

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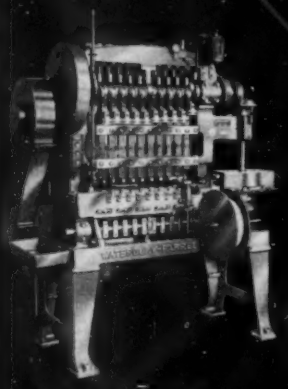

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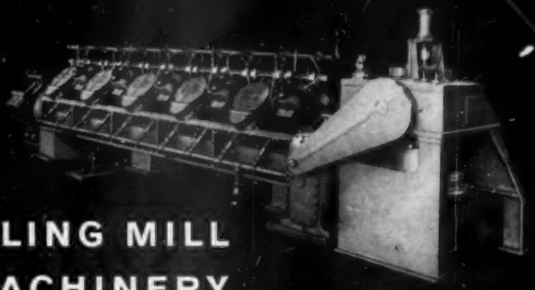

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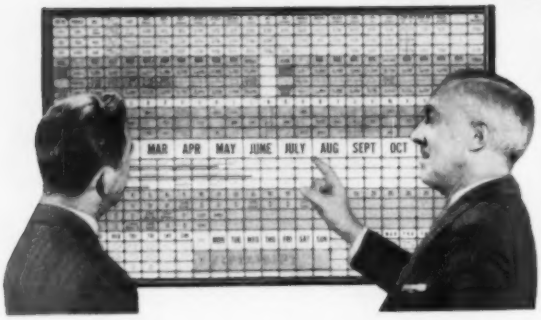

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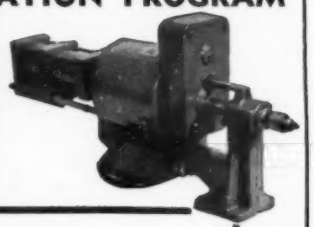
1,000 to 10,000 RPM or 2,500 to 15,000 RPM.
Continuously Variable speed control.



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15 Speeds—
750 to 15,800 RPM.

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600 to 4,000 RPM with Variable Sheaves.

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GATCO ROTARY BUSHINGS
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FOR
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Eliminates expensive tool construction—Reduces tool wear—Prevents seizure and pilot breakage—Especially adapted where precision is required.

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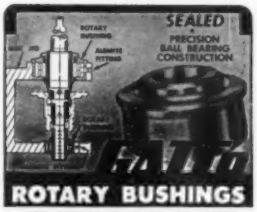

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The inner race of the GATCO bushing rotates with the tool, piloting the tool accurately below or above the work—or both.

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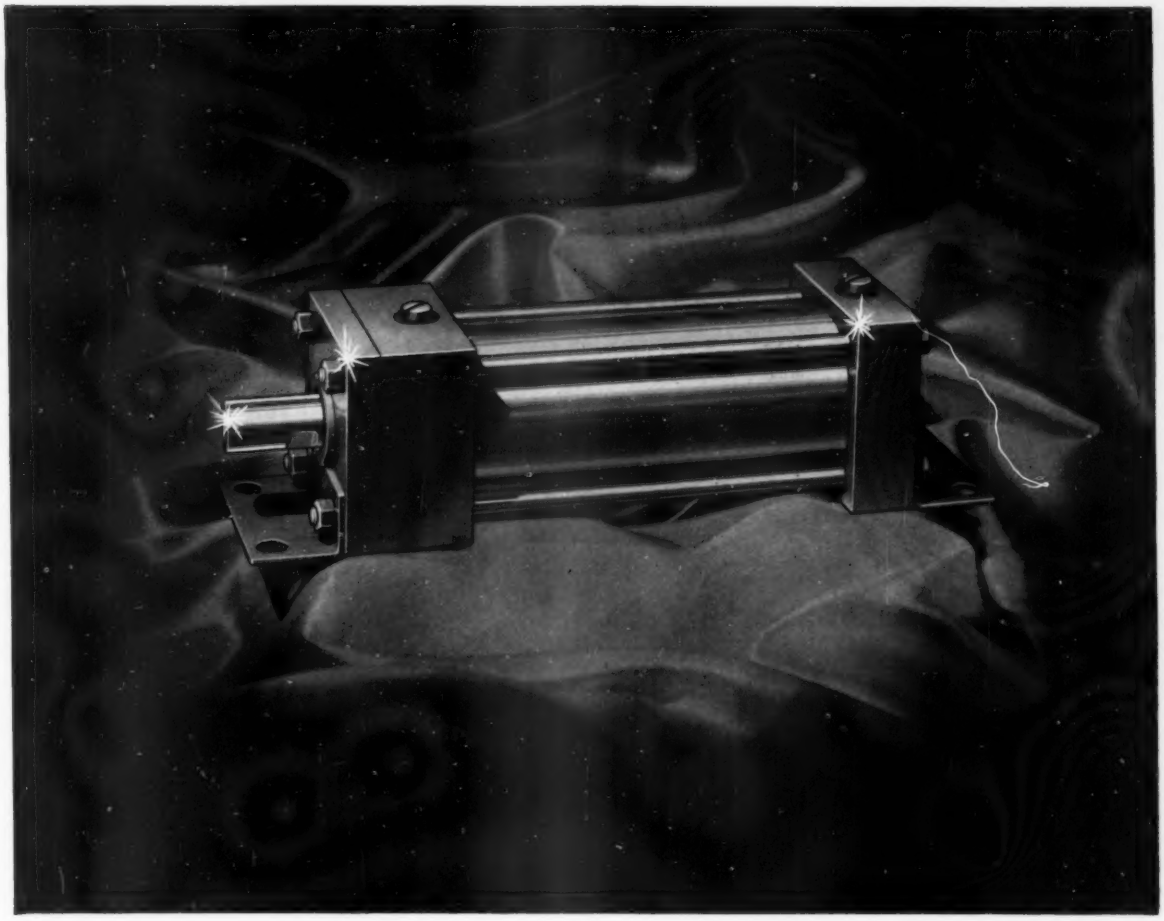
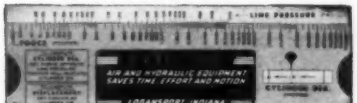


Illustrated—Logansquare Cylinder Meets J.I.C. Standards

Look to Logan

the ultimate in air cylinder design



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A gift to you from Logansport Machine Company upon request.

MEMBER: Natl. Mach. Tool Builders' Assn.; Natl. Fluid Power Assn.

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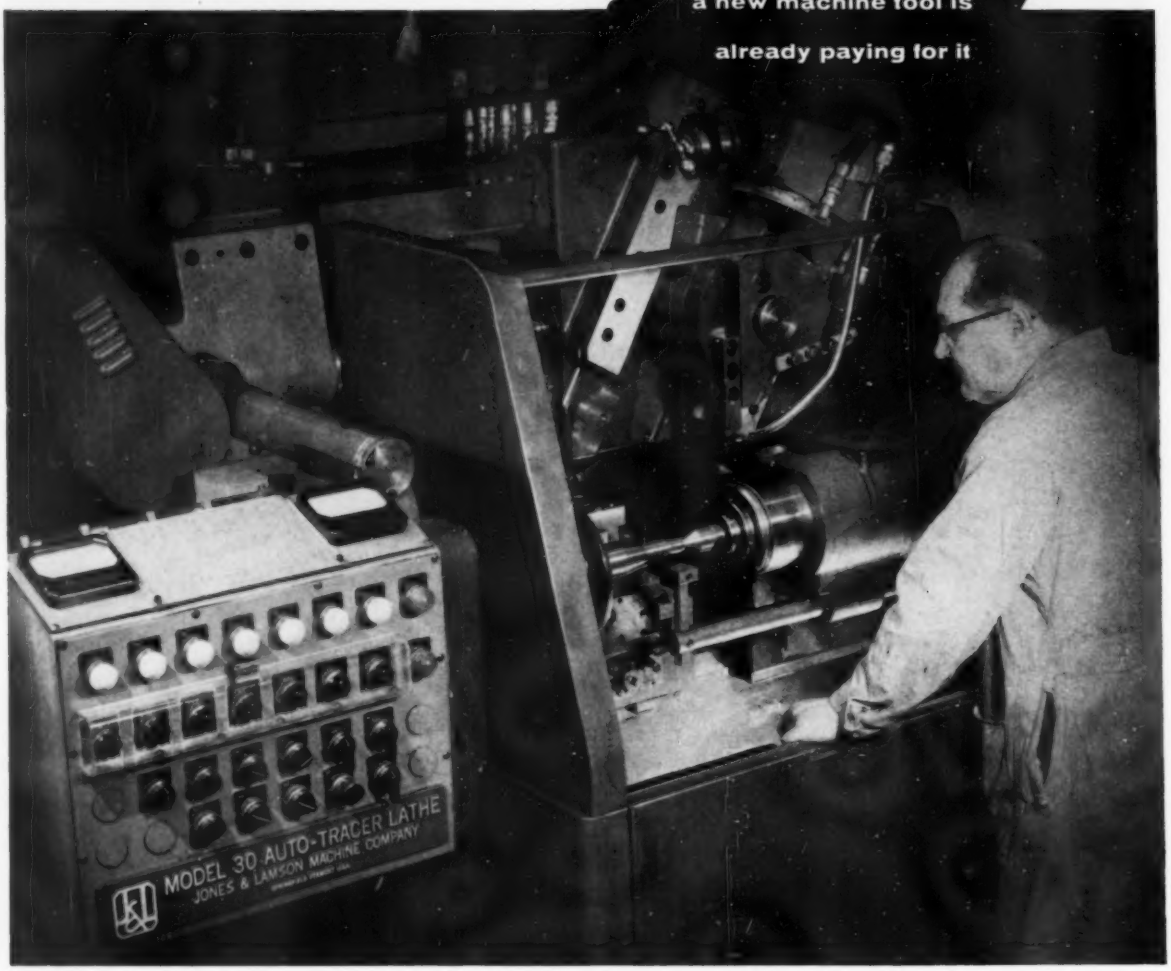
the man who needs a new machine tool is already paying for it



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This new J & L Model 30 Fully Automatic Tracing Lathe combines a number of flexible designed features, *and it's competitively priced.* The basic J & L ingredients of extra ruggedness and extreme precision are apparent throughout. (Note the unusual solidness of the tracing slide, for instance.) Specifically, it offers 1. *Fast and flexible set-ups* which are extremely simple, and accessible to the operator, 2. *Compact and convenient controls* for push-button programming of the automatic cycle, 3. *Automatic speed and feed changes* during a cut, 4. *Work handling facilities* that can be either automatic or manual (there's plenty of room for chip disposal, too).

In addition, this machine will accommodate any one of three different rear slides. It also offers a choice of two different headstocks. Moreover, the stylus and template are high and dry.

Details and specifications are contained in our brochure No. 5810. Write for your copy. Jones & Lamson Machine Company, 518 Clinton Street, Springfield, Vermont.

Turret Lathes • Automatic Lathes • Tape Controlled Machines • Thread & Form Grinders • Optical Comparators • Thread Tools

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Vanadium-Alloys Steel Company

HOT WORK DIE STEELS

for your applications that ask the most of quality on the job

These are the leading die steels for hot work wherever high temperatures make life hard on dies. Their stamina, stability and resistance to wear have made them fixtures in the modern die shop—first choice consistently by men who know *first quality* in steel.

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14% tungsten. High resistance to softening at high temperatures. For piercers, punches, hot forming dies.

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Most widely used hot work die steel. 5% chromium. High strength, toughness, resistance to heat checking. Die casting, extrusion, and hot forging dies; mandrels, etc.

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LATROBE, PENNSYLVANIA

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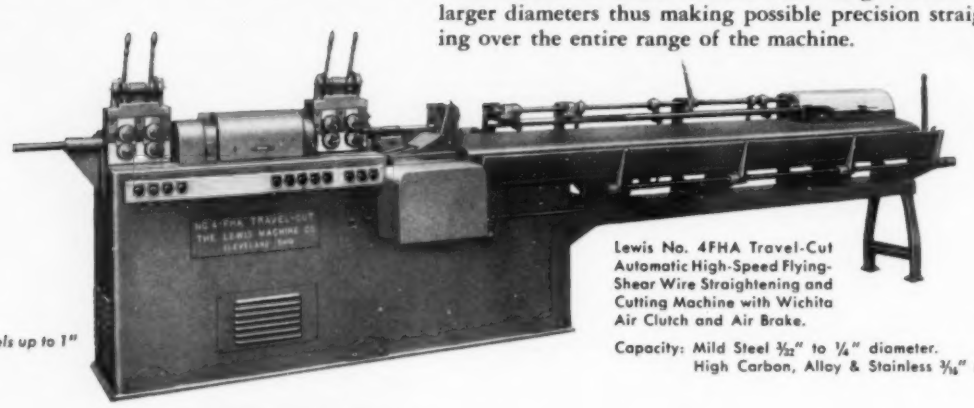
STRAIGHTEN AND CUT WIRE UP TO 500 FPM

This is the most outstanding development in the field . . . the new Lewis No. 4FHA Wire Straightening and Cutting Machine designed to straighten and cut wire in any lengths at speeds up to 500 FPM.

Through the use of a compound sliding-gear transmission 24 gear combinations permit 20 feed speeds — 75 through 520 FPM with 6 flywheel speeds of 95 through 305 RPM. Another outstanding feature is the Dual-Center Straightener Arbor (Pat. Pending) permitting the use of close centers for small diameters and long centers for the larger diameters thus making possible precision straightening over the entire range of the machine.



Other models up to 1"

Lewis No. 4FHA Travel-Cut Automatic High-Speed Flying-Shear Wire Straightening and Cutting Machine with Wichita Air Clutch and Air Brake.

Capacity: Mild Steel 3/32" to 1/4" diameter. High Carbon, Alloy & Stainless 3/16" Maximum.

THE LEWIS MACHINE COMPANY

3441 EAST 76TH STREET • CLEVELAND 27, OHIO

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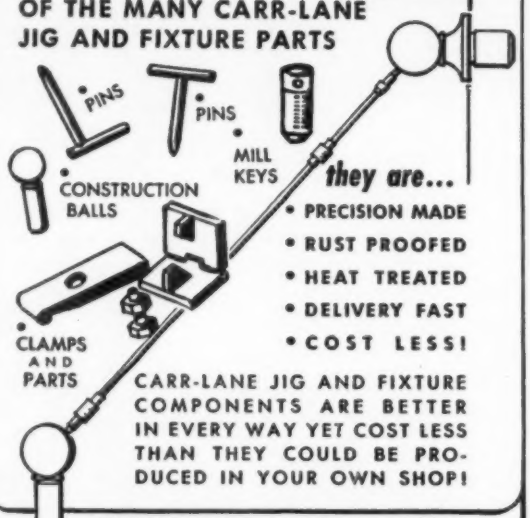
MEASURE THE Value OF THE MANY CARR-LANE JIG AND FIXTURE PARTS



they are...

- PRECISION MADE
- RUST PROOFED
- HEAT TREATED
- DELIVERY FAST
- COST LESS!

CARR-LANE JIG AND FIXTURE COMPONENTS ARE BETTER IN EVERY WAY YET COST LESS THAN THEY COULD BE PRODUCED IN YOUR OWN SHOP!

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Carr Lane MANUFACTURING CO.

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ACCURACY .0002 T.I.R.

.0002 T.I.R. or less at Spindle Nose, .0005 T.I.R. or less on Test Arbor six inches from Spindle Nose

SPINDLE SPEEDS 150 and 250 RPM Other Spindle Speed Pulleys Available

MODEL B943 MOTOR DRIVEN WORK HEAD

No. 11 B & S Tapered Spindle Standard Equipment. No. 12 B & S or No. 5 Morse Available at Slight Extra Cost.

Clip ad to your letterhead and send for Literature

K. O. Lee Company, Aberdeen, S. D.

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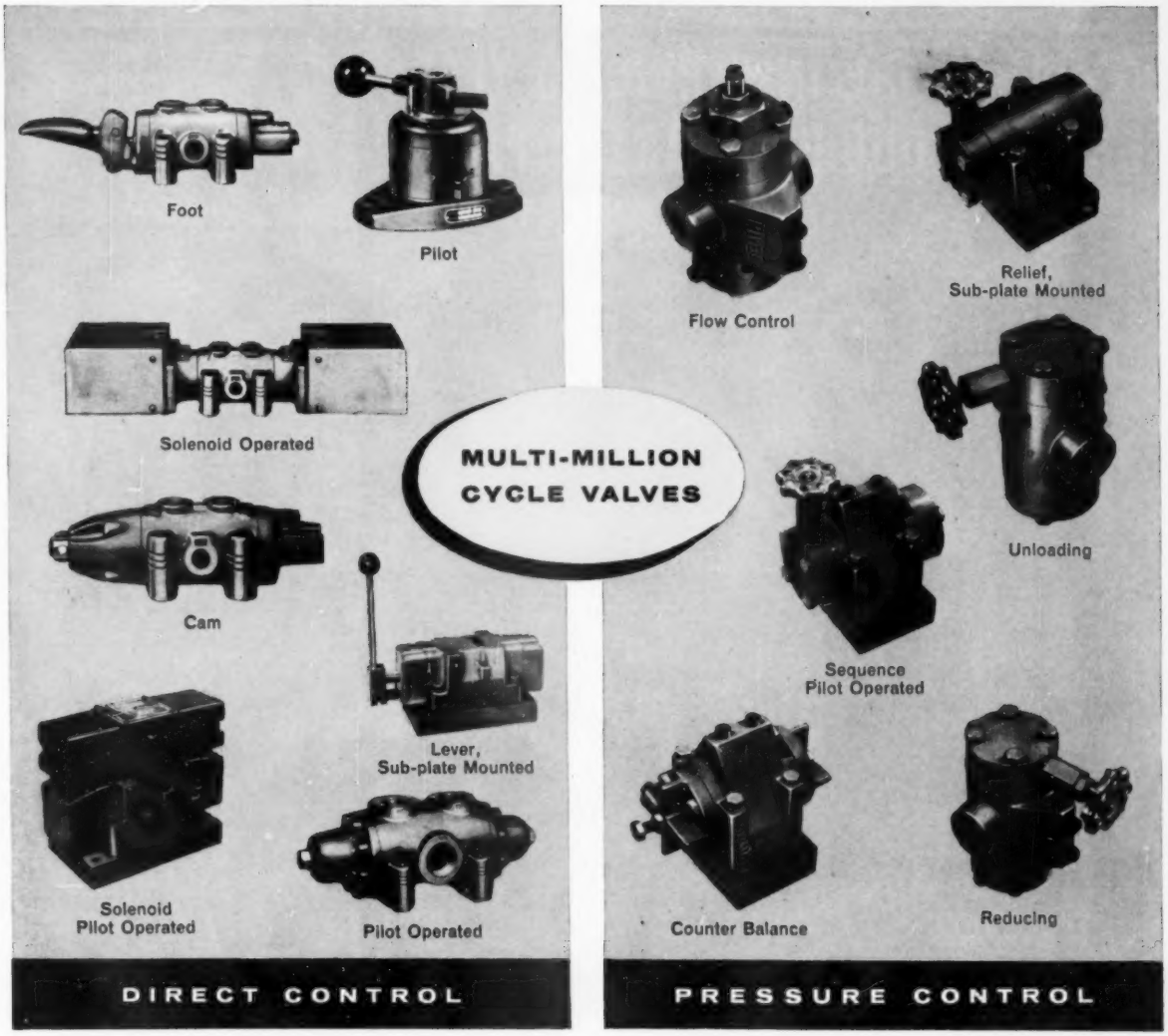

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HYDRAULIC VALVES

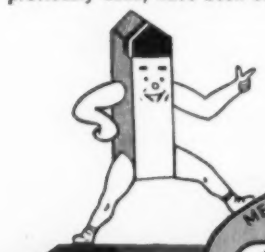
Talide® DIE IN SERVICE 8 YEARS DRAWS 9,000,000 CASTER PARTS!

Bassick Company, Bridgeport, Connecticut, leading producer of casters, chair controls, automobile and specialty hardware, was experiencing difficulty drawing an eccentric shaped chair caster part from commercial quality hot rolled drawing steel.

Scrap rate was high—production per die low. The high-speed steel die being used (costing $350.00) had to be reground and polished every 30,000 pieces, and replaced several times a year.

A Grade C-85 Talide die (costing $1100.00) was installed in 1950 and to date has produced over 9,000,000 caster parts. During this 8-year production run, the Talide die has required no servicing and is still in operation.

Bassick Company engineers report that the quality of their product has been improved. Surface marks and scratches, caused by scoring and galling of the steel dies previously used, have been completely eliminated.



A Talide die engineer can help you cut costs and increase production on draw presses, punch presses, pill presses, cold headers, swagers and draw benches.

METAL CARBIDES CORPORATION
6001 Southern Boulevard Youngstown 12, Ohio

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MC
TALIDE®
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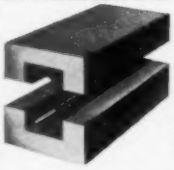
HOT PRESSED AND SINTERED CARBIDES • VACUUM METALS
HEAVY METAL • ALUMINUM OXIDE • HI-TEMP. ALLOYS
OVER 25 YEARS' EXPERIENCE IN TUNGSTEN CARBIDE METALLURGY

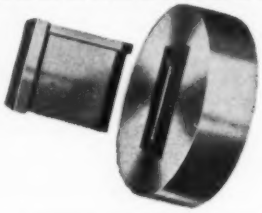
WIRE DIES
Hundreds of miles of steel and non-ferrous wire—.004 to .750—drawn through TALIDE dies.



SWAGING DIES
Leading fountain pen manufacturer cold swages 33 times more stainless steel parts with TALIDE dies.

HEADING AND EXTRUSION DIES
Cold heading ¼" C-1008 rivets, TALIDE dies produced 11,200,000 pieces, other carbide dies only 3,500,000.

CURLING ROLLERS
TALIDE curling rolls last 65 times longer than steel rolls on beverage can forming operation.



BLANKING AND FORMING DIES
70 times more paper discs blanked out with TALIDE—over hard alloy die.

SHEET METAL DIES

137,000 hi-alloy steel pressure vessels drawn with TALIDE against only 7,900 with steel dies previously used.

POWDERED METALLURGY DIES
Compacting highly abrasive chemical powders, TALIDE pill dies last 4 months; steel dies wore out in 6 hours.

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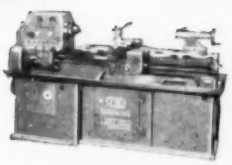
NOW THE WORLD'S GREATEST VALUE IN A COPYING LATHE.

THE CLEARING-HARRISON

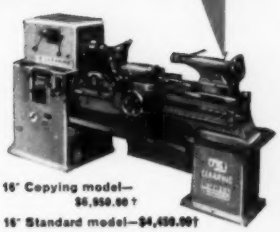
Just $375.00*

†Base Price F.O.B. Chicago, Los Angeles, New York.

* 11" Copying model—$3,750.00†
Standard 11" model—$1,950.00



13" Copying model—$4,850.00†
13" Standard model— $2,950.00†



16" Copying model— $6,950.00 †
16" Standard model—$4,450.00†

Here are copying lathes at prices you would normally expect to pay for a standard machine! Yet the Clearing-Harrison is a world beater of a lathe—carefully designed and as rugged as they come.

Check These Features!

Standard Duty—Copying mechanism doesn't interfere with the use of the lathe for standard operations.

Induction Hardened Bed Ways—Ways are hardened and ground by Delapena equipment—virtually exclusive with the Clearing-Harrison

Precision hardened gears

Anti-Friction Bearings to the Spindle

FIND OUT MORE ABOUT THE COPYING LATHE YOU CAN OWN FOR WHAT YOU'D EXPECT TO PAY FOR A STANDARD MACHINE. WRITE CLEARING TODAY!

Clearing, division of U. S. Industries, Inc. also manufactures the Clearing-Axelson line of engine lathes, power presses of all types, dies and special tooling and special equipment for the aircraft and missiles industry.

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Clearing's nationwide facilities assure you of prompt service always. Replacement parts and accessories are stocked at Clearing and are available through all three plants, at all service centers and through all Clearing dealers.

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EDGCOMB EVERTRUE VERNIER SCALES bring Better - Than - New Accuracy To Any Machine

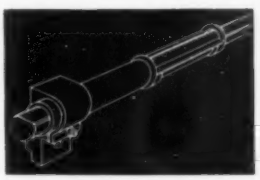
- SIP engraved graduations guarantee extreme accuracy IN ANY LENGTH—not cummulative.
- Leadscrew error accumulation cannot put you out of tolerance at that far end.
- Backlash confusion can never again scrap a part.
- Lost count of the turns will never put the hole in the wrong place.
- Evertrue Scales are easily set to "0" and show exactly where you are at all times.

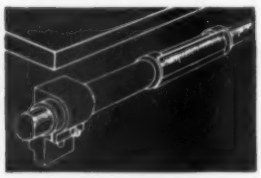
ROTATABLE

Well engineered design permits the entire scale and vernier assembly to be rotated in its bracket.

Loosen only two screws and your Evertrue Scale is free to rotate. Tighten the same two screws to lock secure and rigid.

TURN IT UP . . .
for the best illumination and easiest reading.





TURN TO THE FRONT
to read under that overhanging fixture.

EASY READABILITY WHERE IT COUNTS

ACTUAL SIZE

the correct reading is 5.510

The easily read extra long vernier reduces eye strain, fights fatigue, prevents costly mistakes and speeds up the job.

The expanded vernier, black on chrome satin finish, and rotation to catch the light, all contribute to the amazing readability.

Flat scales eliminate parallax and distortion, prevent errors, assure finest workmanship.

YOUR ORIGINAL PRECISION CAN NEVER WEAR OUT

Wear is "designed out" and can never change the original accuracy. Unlike leadscrews, Evertrue Scales do not depend on rubbing, mating surfaces so therefore cannot wear.

The same fine equipment and skill used to produce Evertrue Vernier Scales can help solve YOUR problem jobs . . . . .

Engraving
Precision Graduating . . . circular and linear
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Entire plant temperature controlled for greatest precision

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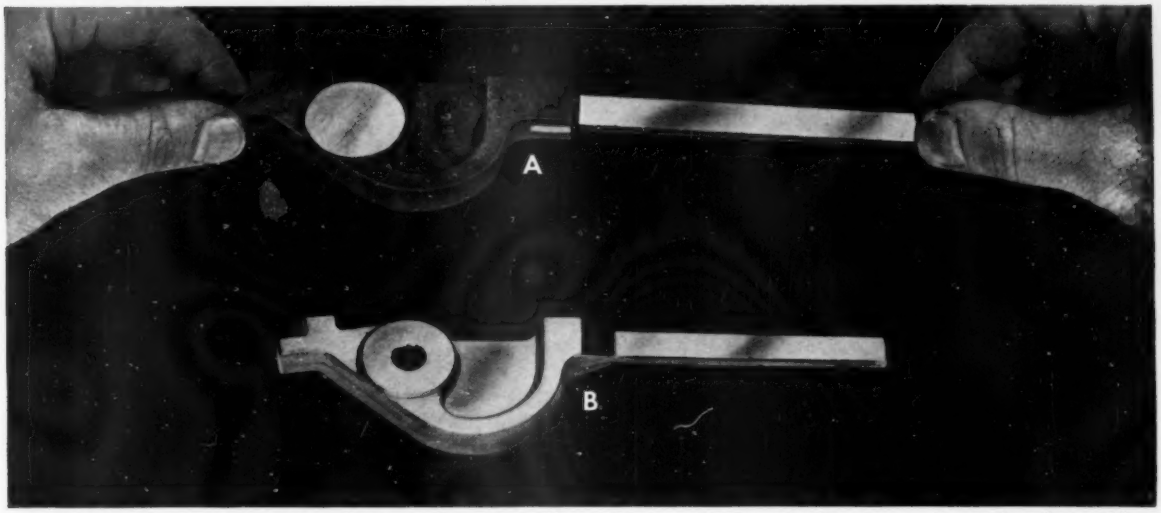
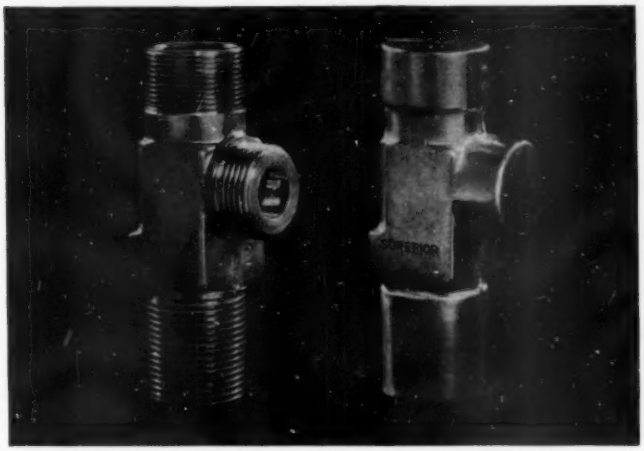
QUALITY CONTROL PLUS SAVINGS Value analysis suggested the use of a die-pressed forging. The result: an 85% cost reduction and a stronger, tougher part.



SWITCH BLADE in overspeed limiting device on large General Electric motor-generators was originally an assembly **A**—an arm brazed to a brass casting which was machined, slotted, and drilled. After review in the company's Value Analysis program, assembly was replaced by Anaconda die-pressed brass forging **B**. The superior strength of twice-wrought metal made possible a one-piece part. The excellent finish and consistent dimensional accuracy of the die-pressed forgings eliminated all machining but the drilling operation. The over-all cost is 15% of the original part.



VALVES FOR CHLORINE AND FLUORINE shipping containers must have unusual corrosion resistance and high strength. Superior Valve & Fittings Co., Pittsburgh, specialists in handling halogens, looked for a forging alloy that would be suitable. American Brass Company metallurgists suggested die-pressed forgings of a slightly modified Everdur®-1014, an aluminum-silicon bronze, for this chlorine-fluorine service, and this customer is finding wide use for it in other severe service, too. The twice-wrought metal of Anaconda die-pressed forgings has dense structure to prevent leaks—strength and toughness to take rough handling. Yet it can be machined in automatic-chucking machines resulting in good cost control.

THE vital job of controlling quality *and* costs may be easier than you think. Anaconda technical specialists will gladly help you find the right alloy and mill form to do both. See your American Brass Company representative or write: The American Brass Company, Waterbury 20, Conn. In Canada: Anaconda American Brass Ltd., New Toronto, Ont.

DIE-PRESSED FORGINGS SPECIAL-SHAPE TUBES
EXTRUSIONS FABRICATED METAL PARTS

products of

ANACONDA®

made by The American Brass Company

JEMCO MACHINE TOOLS

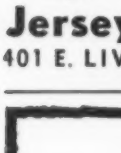
PUNCH SHAPER—SAVE FROM 50% to 80% MACHINING TIME. Machines contour surfaces, metal stamping punches with curved necks, brass electrods, etc. Complete in one set-up to within a guaranteed accuracy of ±.00025".
Let us quote on your special punch requirements.

10 SPEED TURRET DRILL HEAD—SAVE FROM 40% to 60% MACHINING TIME. Fits any single spindle vertical drill press or miller. Drills 2 to 7 holes . . . taps 2 to 7 sizes in one set-up.

QUICK SET UP TOOL ROOM SHAPER—competely equipped—all set-ups take less than 5 minutes.

DISC FILER—Eliminates hand filing—for all metals, wood and plastic.

DISC FILER—Files any angle or radii in seconds. Easily adaptable for production line output. Fixtures easily mountable.



DRILL GRINDERS—Range .012" to 3".

DRILL GRINDERS—Floor and Bench Models.

Jersey manufacturing co.
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Guaranteed to outperform and outlast any other LIVE CENTER.

The WHOLE HEAD turns on Double Row Ball Bearings for Radial Load and Tapered Roller Bearings for Thrust Load.

MARVEL TOOL & MACHINE CO.
1086 North River Road • St. Clair, Michigan
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TRIED • PROVEN • GUARANTEED MICRO MINIATURE END MILLS

3 Flute Ball End
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Single End
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⅛" Shank
3/16" Shank

Stub Length—1/32" Increments from 1/32" to 3/16"

Now 1/64" Increment Sizes in 2 Flute Single End type

When you think of small END MILLS —think of MICRO MINIATURES

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Carbide Tipped and Solid Carbide CUTTING TOOLS

It costs no more to enjoy the production advantages of MEYCO tools: "precision" minded since 1888, careful workmanship, well equipped shops and capable design engineers . . . all add up to plus values for you.

The finest quality and proper grade of tungsten carbide is engineered to the cutter's job. Tools are precision ground and lapped for long life, tipped to carefully machined bodies balanced for rigidity. MEYERS works to tolerances of .0001", tipped cutters as thin as .030", solid carbide cutters much thinner, diameters of 1/4" and up.

Your special problems in the field of cutting, slitting, slotting, under-cutting or form-cutting are solicited.

Write for new Cutter Catalog No. 52

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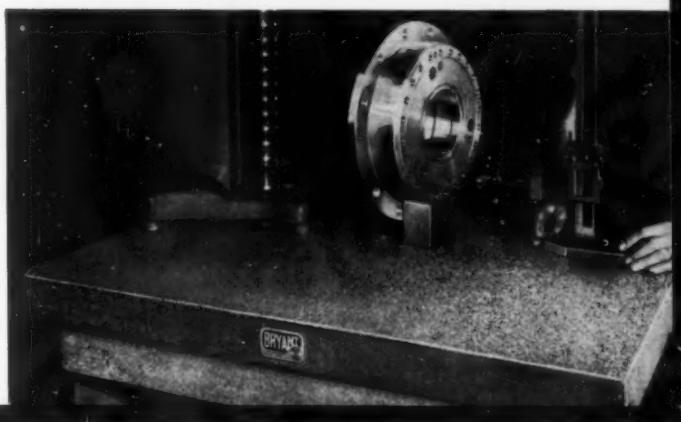
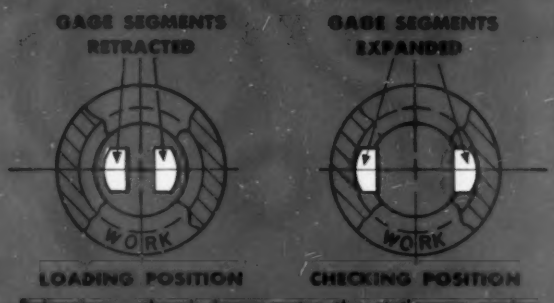
TO BE SURE OF ACCURACY

. . . be sure it begins on a BRYANT SURFACE PLATE

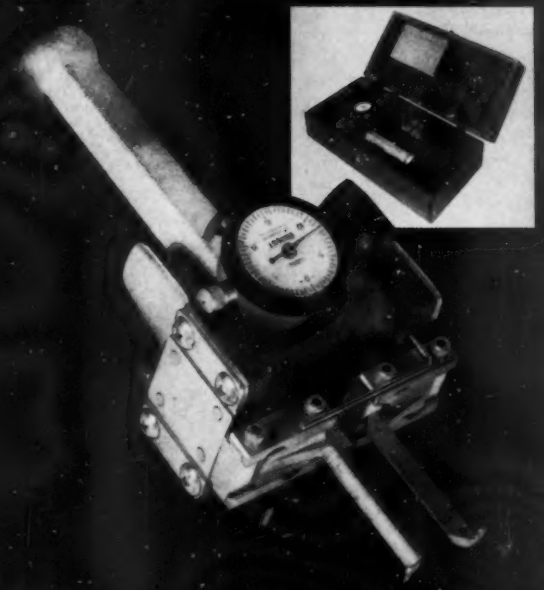
Proved longer-lasting in impartial wear tests, Bryant Surface Plates provide clearly defined flatness plus surface-wide hardness and homogeneity. True savings come from Bryant-patented "head of the grain" finish and the finest Vermont quartz granite. Select from a variety of standard or special sizes, available with modern welded steel stands.





Releasing a thumb lever mates the stationary gaging segment and a movable segment to the groove; movable segment actuates a precision dial indicator. Because there are no slides or pivots, dirt and cutting oil cannot affect operation.

Complete Bryant Portable Groove Gage Kit checks snap ring grooves No. 25 to No. 500, and "O"-ring grooves No. 6 to No. 52.



. . . be sure it's checked on a BRYANT GROOVE GAGE

A precision-made portable gage for use at inspection bench or machine, the Bryant P-21 Groove Gage checks parts with snap-ring, "O"-ring or special grooves. Lightweight and easy to use, the P-21 gives visual comparator readings of groove diameter and roundness. Adjustable for diameters to 13″, the P-21 Groove Gage is available with standard attachments and special accessories for checking concentricity of groove to bore diameter, for checking internal threads (in all tolerance classes and sizes from 5/16″ to 5″ diameter), and parts with special recesses, diameters or groove depth.

FREE FACT-FOLDERS—Engineering data and prices on the full line of Bryant Internal and External Thread and Groove Gages. Also—the full story of Bryant Granite Surface Plates; gives you *all* the facts before you buy!

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EX-CELL-O CORPORATION XLO

Greenville Plant, 945 E. Sater St., Greenville, Ohio

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YOU'LL FIND IT HERE

the abrasive wheel with the characteristics you want

SIMONDS CUT-OFF WHEELS

For cutting metals *and* costs, use these abrasive wheels. They are just about the quickest, most efficient way to cut all kinds of metal and non-metals, and, since Simonds makes them in all grain, grade and bond combinations, you are sure of getting the ones exactly suited to *your* needs.

Regular Resinoid bonded for the rigors of high speed operation. Borolon (aluminum oxide abrasive) for steel bars, tubes, angles, etc. Electrolon (silicon carbide) for cast iron, bronze, brass and non-metals.

Reinforced Resinoid bonded for added strength. Double XX wheels have the same fast action of ordinary resinoid bonded wheels, plus the extra strength of glass fiber reinforcement on both sides. For metals and non-metals, including all building materials except wood.

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Reinforced Rubber bonded for extra safety. For swing-frame cutting on gates, risers, etc. Available with (1) Standard Reinforcement; fiber glass on both sides (2) Double Reinforcement; reinforced internally in addition to both sides, or (3) Triple Reinforcement; two internal reinforcements in addition to both sides.

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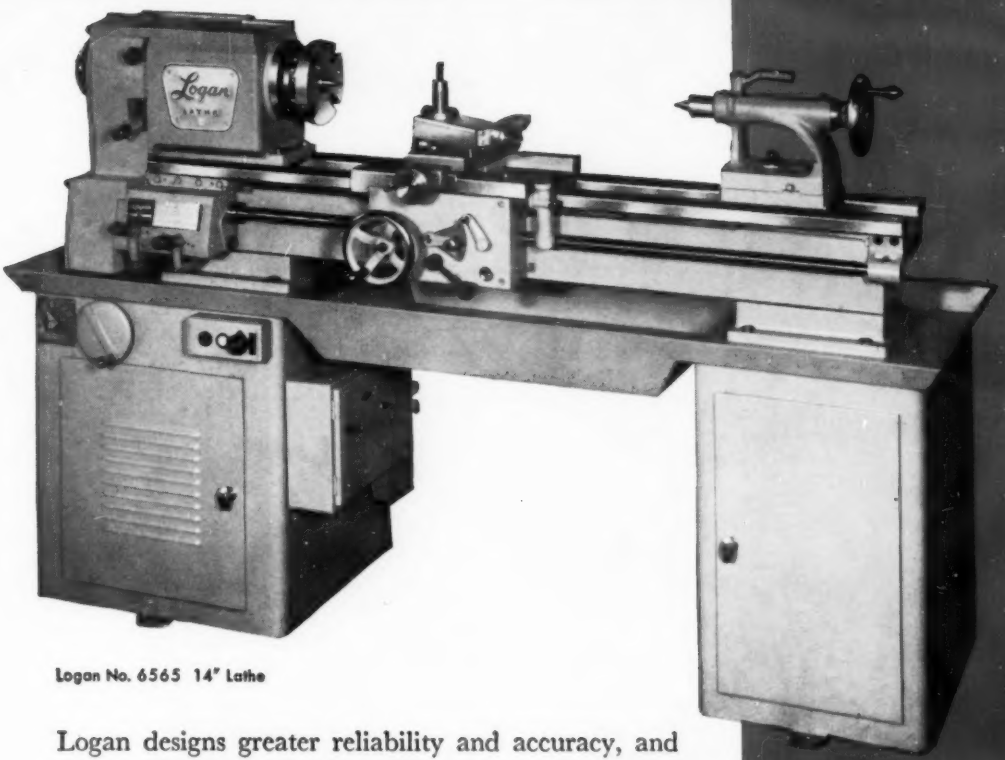
its specifications add up
to high production capacity

Logan
14" Lathe



Logan No. 6565 14" Lathe

Logan designs greater reliability and accuracy, and longer life into its lathes by a generous combination of high-quality features. For instance—

- An oversize spindle with 1⅝" bore turns on four super-precision ball bearings with built-in preload
- A variable-speed drive lets you change speed while work is turning—without shifting belts
- A warp-free lathe bed with high, strong walls braced by oversize ribs to withstand heaviest stresses; two V-ways and two flat ways are flame-hardened and precision-ground.

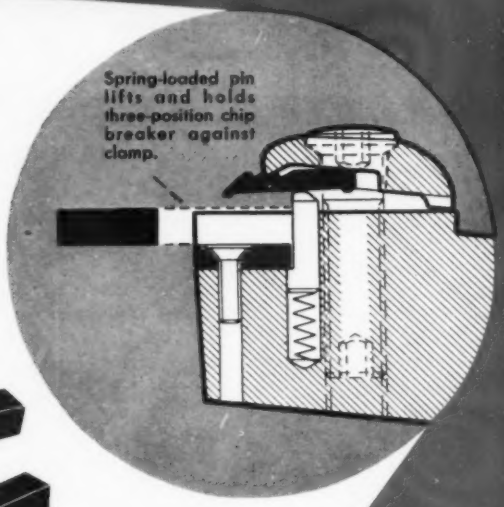
There are many more reasons why this and other Logan Lathes have a greater capacity. The specifications tell the story. Write for literature and complete information.

- Spindle speeds to 2000 rpm.
- 1½" Levermatic collet chuck capacity
- 14⅝" swing over bed
- 9" swing over saddle cross slide
- 40" between centers

LOGAN ENGINEERING CO. Dept. U-1159 4901 Lawrence Ave., Chicago 30, Ill.

FASTEST FAMILY of *FUMBLE-FREE* Toolholders!

SANDVIK *Coromant* T-MAX



A wide range of styles and sizes in Positive and Negative Rake holders to handle almost any machining job.

•

Exclusive, "Autolift" triple-purpose, low cost, solid carbide chip breaker.

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Shim held by exclusive tempered spring pin. No screw to "freeze" or bind.

•

T-Max lets you change carbide cutting edge and chip breaker width without removing or replacing chip breaker.

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Man-made diamonds add the newest "Touch of Gold" value to carbide grinding

In carbide grinding the product-improving, cost-cutting "Touch of Gold," created by Norton leadership in diamond wheel development, began back in 1930. Today, man-made diamonds are adding something new to the "Touch of Gold." Their use as abrasives is steadily increasing, because of their improved performance and economy.

Norton was first to introduce all three bond types of diamond wheels . . . manufactures with complete uniformity of specification . . . produces the largest line . . . and *certifies* the diamond content of each wheel. Today, similar pioneering continues Norton leadership in the use of man-made diamonds . . . bringing you better performance, longer service life and lower grinding cost for every dollar you spend. NORTON COMPANY, Worcester 6, Massachusetts.

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ABRASIVES

Making better products . . . to make your products better

NORTON PRODUCTS: Abrasives • Grinding Wheels • Grinding Machines • Refractories • Electrochemicals — **BEHR-MANNING DIVISION:** Coated Abrasives • Sharpening Stones • Pressure-Sensitive Tapes

Once you've tried
Jetweld Low-Hydrogen Electrodes,
you'll agree with us when we say,

There's no such thing as hard-to-weld steel!

Sulphur-bearing steels that normally can't be welded without porosity—

High-tensile steels that are susceptible to underbead cracks and microcracks—

Heavy plate on which welds often crack—

All are welded easily and successfully, in any position, with Jetweld Low-Hydrogen rods.

An iron powder coating makes for fast, smooth operation.

And three tensile classifications handle every Low Hydrogen application.

Jetweld LH-70, E-7018,
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Jetweld LH-110, E-11018-G.

Try them for the very finest physical properties and on steels you thought were tough to weld.

LINCOLN ...USA

THE LINCOLN ELECTRIC COMPANY
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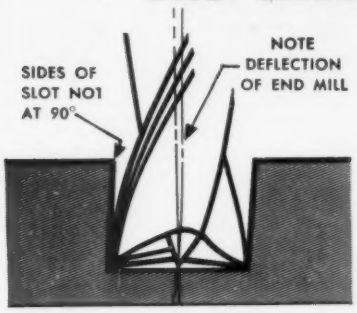
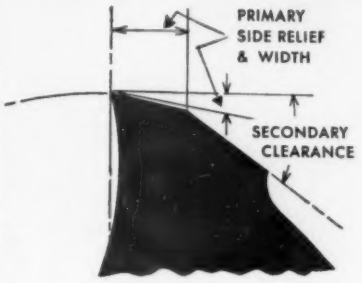
The world's leading manufacturer of arc welders and electrodes, ac motors and battery chargers.

END MILL TIPS YOU CAN USE



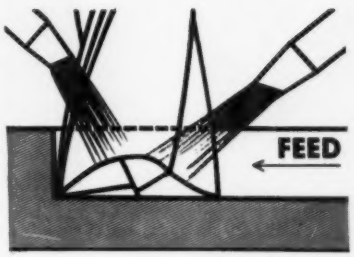
"WOBBLE"... ITS CAUSE AND CURE

Non-perpendicular sides of a slot can be caused by a worn spindle, excessive flute length, or too slow spindle speed. This "wobble" slot is actually a deflection of the end mill caused by one flute hogging into the cut. If the proper end mill with shortest necessary flute length is being used, eliminate spindle runout and increase its speed.



END MILL RESHARPENING

Always consider the material to be cut, and grind to limits recommended by the tool manufacturer. It is best to resharpen end mills to produce just enough primary relief to eliminate drag. Too much relief causes chatter . . . brings on rapid dulling of cutting edges. Secondary relief depends on the size of the end mill, the width of the primary relief, and the feeds being used.



ABOUT CUTTING FLUIDS

End mills require cutting fluids to protect the tool, control temperatures, and provide lubrication. Multiple streams generally provide more cooling effect than a slow moving heavy flow. Remember that present day jet cooling methods do not provide sufficient cooling because of greater tooth-to-work contact in end milling as opposed to turning operations.

FOR QUICK SOLUTIONS TO **ALL** YOUR DRILLING-REAMING-END MILLING PROBLEMS,
SEE CHICAGO-LATROBE CATALOG No. 58, OR CONSULT A C-L SERVICE ENGINEER

BEST TIP OF ALL . . .

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DRILLS • REAMERS
END MILLS • COUNTERSINKS
COUNTERBORES • CARBIDE TOOLS
SPECIAL TOOLS and THE **NEW**
"LO-TORK" CHIP BREAKER DRILLS

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INDUSTRIAL DISTRIBUTORS — SERVING INDUSTRY ECONOMICALLY — THE RIGHT HAND OF PRODUCTION

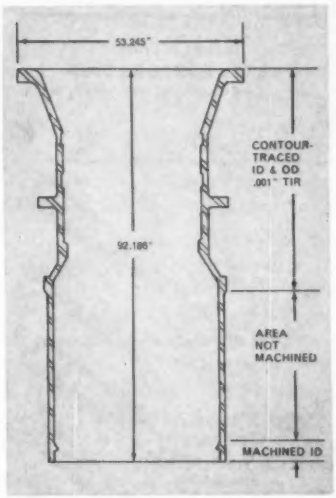
CHICAGO-LATROBE 411 W. ONTARIO ST., CHICAGO 10, ILLINOIS

World's tallest
12-foot precision vertical boring mill has 15'-6" clearance under rail, 150-ton table load capacity, 110" ram travel, and 151" swing.

Machining big work to small part accuracies

No piecepart is too heavy or too high to make accuracy a problem on a G&L vertical boring mill.

Precision machining of big atomic reactor vessels at the R. H. Freitag Corporation, division of Alloy Manufacturing Corporation, provides a good example of the capabilities of these machines. Parts are Meehanite castings which are first machined undersize, then clad with 347 stainless and carbide-machined to final size and finish. Diameter tolerances of ± .001″ with .003″ TIR* on contour are required. Freitag is holding .001″ TIR on parts 92″ high and will be able to machine well within the precision required on parts which will require the full 186″ under-the-rail clearance on the machine illustrated.



Accuracy of contour 92″ above table held to .001″ TIR by G&L 12-foot vertical boring mill with electric tracer attachment.

All G&L vertical boring mills are designed to deliver precision accuracies regardless of the size of the workpiece. Antifriction roller bearing table tracks are standard. A preloaded, tapered center roller bearing eliminates table tilt regardless of size or weight of workpiece. A double-walled, heavily ribbed unit bed-and-transmission assures a level, smooth-running table.

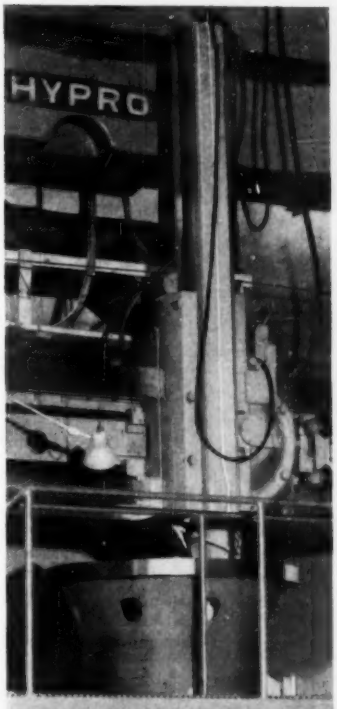
These design features result in low friction, low heat build-up, and uniform heat dissipation so that any size workload can be run *continuously at any speed* without loss of accuracy.

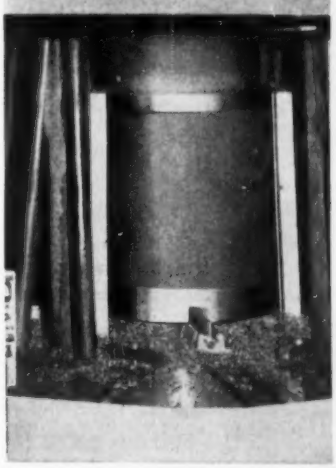
Massive ribbed box-type head, rail, and housing construction match the bed and table design to assure a machine with deflection-free rigidity under the most severe operating conditions.

For complete details on the *high-accuracy, heavy-capacity* boring mills from 54″ to 20′, call your G&L distributor or write to GIDDINGS & LEWIS MACHINE TOOL COMPANY, Fond du Lac, Wisconsin.

*Total indicator runout.

Tracer machining 92″ high atomic energy vessel to accuracies of .001″ at the R. H. Freitag Manufacturing Corporation, division of Alloy Manufacturing Corporation, subsidiary of Salem-Brosius, Inc., Pittsburgh.





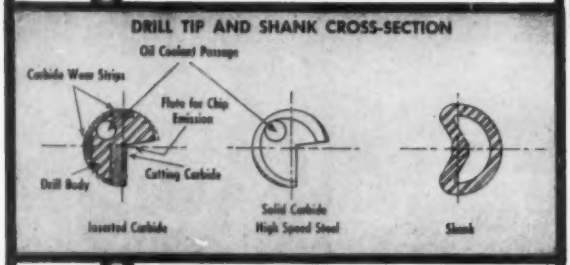
GIDDINGS & LEWIS

Giddings & Lewis manufactures: vertical and horizontal boring machines, vertical turret lathes, planers, planer mills, contour milling machines, die sinking machines, drilling machines, numerical and tracer control systems, boring tools and related items, and machine tool accessories.

THIS DRILL ELIMINATES SECONDARY OPERATIONS

Just *one* pass with these high-speed steel or carbide-tipped gun drills produces an accurate, truly round, straight hole honed to mirror-bright finish. That's why you can drill small parts of all kinds — *faster, more accurately* and at *lower cost* with HI-STANDARD Gun Drills*.

Production parts that once had to be drilled individually can now be gang-nested and drilled through, producing holes identical in size, location and finish. Drilling of this kind is done on automatic indexing machines, lathes, horizontal and upright drilling machines, and similar equipment. Forced oil feed through the drill clears chips and cools cutting edge for faster drilling. No matter what the size or shape of your workpiece, drilling with HI-STANDARD Gun Drills is an



outstanding time-and-money saver. Any material that can be *machined*, can be *gun-drilled*.

Gun drilling is one important way in which forward-thinking manufacturers are increasing production and cutting costs. To find out how your company can do the same, write for your Hi-Standard Engineering File 20 *today!*

*Also called "deep-hole drills"

Pioneers in the Design and Development of Gun Drills for more than 30 Years

THE **HIGH STANDARD**
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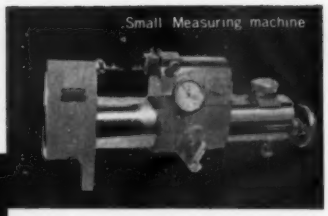
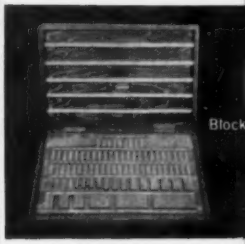
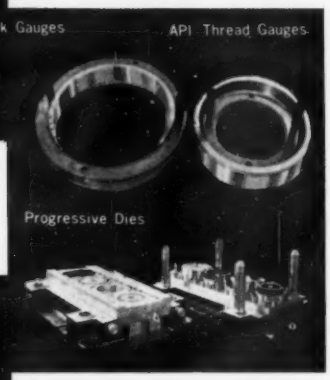
GAUGES and DIES







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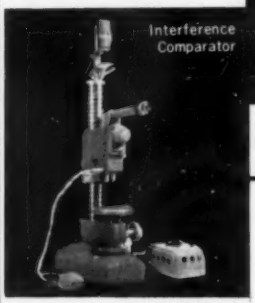

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TOKYO, JAPAN

EXPORT AGENTS
UEKI CORPORATION
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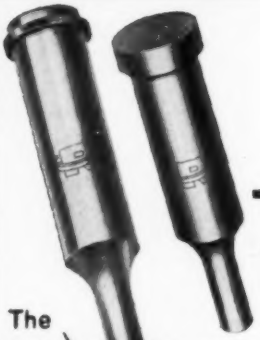

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Specials made to your specifications.
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INCORPORATED
Jamestown, New York

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General Electric announces the new Adjust-O-Breaker toolholder!

Carboloy® toolholder with adjustable chipbreaker lets you adjust from any angle . . . offers any desired adjustment within its range* . . . features "floating" indexable chipbreaker with absolute repeatability.

MORE jobs with *LESS* tooling—that's what you get with this new Carboloy® Adjust-O-Breaker toolholder! No need to have a separate chipbreaker for every cutting job. No need to restrict yourself to toolholders with only two or three chipbreaker settings. Now you can have this versatile new Carboloy toolholder . . . and *adjust it for any chipbreaker setting within its range.**

Available right now from stock in 5 styles, negative rake, for left- and right-hand machining, the Adjust-O-Breaker truly brings new meaning to disposable tooling.

So, to get cutting tool versatility that lets you handle *more* jobs with *less* tooling, check into the complete Carboloy line—Lift-O-Matic (positive rake, negative rake, and tracer), heavy-duty, and the new Adjust-O-Breaker toolholder. The complete line of Carboloy inserts, insert seats, convertible seats, and brazed tooling is the *broadest* in the industry . . . designed to meet *every* tooling need to give you BETTER PROFITS THROUGH BETTER TOOLING.

See your Authorized Carboloy Distributor now. He's listed in the Yellow Pages. *Metallurgical Products Department of General Electric Company, 11101 E. 8 Mile Road, Detroit 32, Michigan.*

CARBOLOY®
CEMENTED CARBIDES

METALLURGICAL PRODUCTS DEPARTMENT
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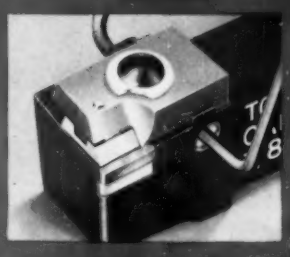
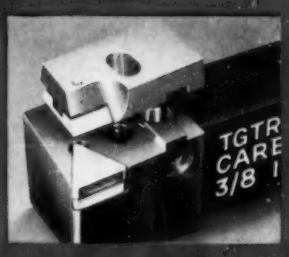
CARBOLOY® CEMENTED CARBIDES
MAN-MADE DIAMONDS • MAGNETIC MATERIALS
THERMISTORS • THYRITE® • VACUUM-MELTED ALLOYS

Metallurgical Memo from General Electric

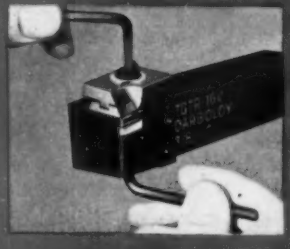
*Sizes 16V and 85V: adjustable range 1/16" to 5/8"
Size 20V: adjustable range 1/8" to 1/4"



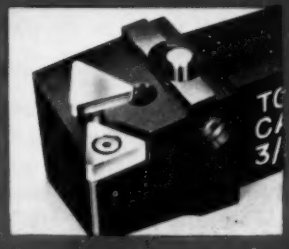
1. Chipbreaker setting adjusts to any width within range.* Set screw with two open ends provides access from either side. No springs to adjust.



2. Design permits absolute repeatability of settings. Floating chipbreaker is indexable. Can't drop out when clamp is loosened.



3. Clamp screw is accessible from top or bottom; allows easy indexing or replacement even when toolholder is vertical or upside down.



4. Standard disposable inserts, Carboloy heart seats and convertible seat are used with toolholder. Insert seats are indexable and self-aligning.

Automatic Hobbing

The Multicycle versions of the Barber-Colman No. 6-10 and No. 16-16 hobbing machines are designed for maximum production of mass-produced parts or those which are to be changed at relatively frequent intervals. Automatic cycling is combined with easy setup in these standard machines to which standard units are added. These Multicycle machines are not special machines, but the standard units can be used in various combinations to produce your job most efficiently. These machines can also be equipped for automatic loading when desired.

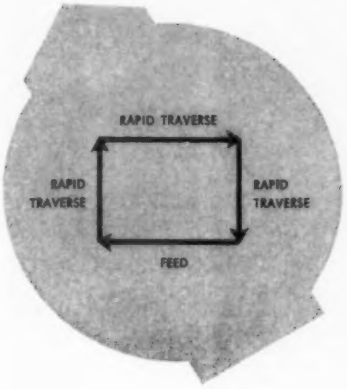
The machine is easily set up for automatic cycling. None of the Barber-Colman versatility is lost. Jobs can be changed as quickly and easily as ever. After the machine has been set up, the operator unloads, loads and presses the start button. Because of the automatic cycling, these machines are equally adaptable and efficient for the mass production of one specific part.

Reduce Approach Time

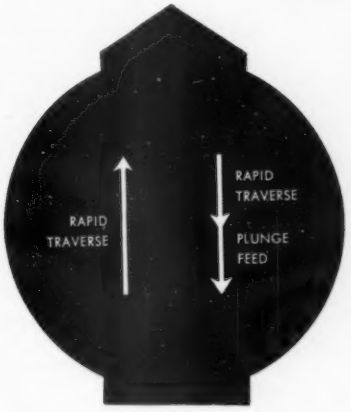
Approach time is often a high percentage of the total time required to produce a gear.

The plunge-approach cycle is designed to reduce approach time to a minimum. The horizontal feed is engaged at the start of the cycle so that the desired helix angle will be cut. The work feeds vertically into the hob until it reaches full depth. The vertical feed changes constantly from a fast feed at the beginning of

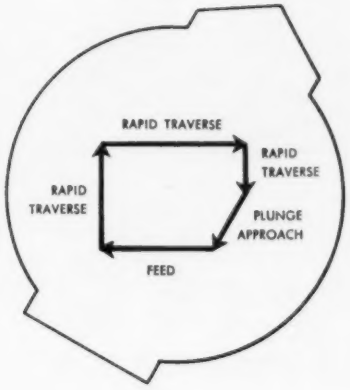
Any one of these automatic cycles can be selected simply by turning a switch on the control panel.



SQUARE CYCLE – automatic version of the conventional hobbing cycle.



PLUNGE CYCLE – automatic vertical feed for cutting worm gears.



PLUNGE-APPROACH CYCLE – combination of "plunge" and "square."

. . . with typical Barber-Colman versatility

the cut to a slow feed as the hob reaches full depth. The vertical feed and rapid traverse are controlled by the vertical feed cam. The rate of vertical feed is infinitely variable.

The plunge-approach cycle allows the use of larger hobs with more flutes or threads without an increase in approach time. More flutes can be used for greater accuracy and higher production, and more threads will normally result in an increase in production. This cycle can be used advantageously for cutting blind worms or blind gears.

Square and Plunge Cycles

These machines can be set up for square cycle with conventional or climb cut in either direction, and for plunge cycle for worm gears. Cycling is completely automatic for both arrangements.

Get Multicycle Production Estimate

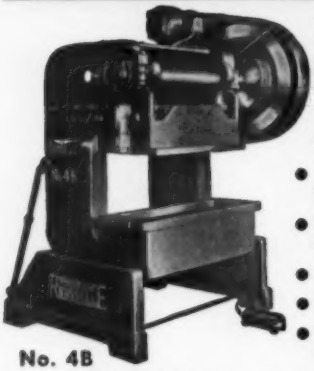
Send us your gear prints for a production estimate on a Multicycle machine. Call your nearest Barber-Colman field office or the factory, WO 8-6833.

Barber-Colman Company

BARBER COLMAN

113 Loomis Street, Rockford, Illinois

New 40-TON DOUBLE CRANK O.B.I. ROUSSELLE



WITH NEW ELECTRICALLY CONTROLLED AIR CLUTCH

- "Plug-in" foot and hand controls.
- Single stroke, continuous and jog selector.
- Low air consumption.
- Large die area.
- Roller bearing flywheel.
- Bronze main and crank bearings.

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SERVICE MACHINE CO.

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ZIEGLER FLOATING TOOL HOLDERS INCREASE TAPPING AND REAMING PRODUCTION

FAST SET-UPS—automatically compensates for misalignment up to 1/16" on dia. between machine spindle and work.

Free-Floating, Easy-To-Use Ziegler Tool Holders permit machine operators to maintain production without scrappage due to alignment inaccuracies, eliminate bell-mouthed and oversize holes and keep job set-up costs to barest minimum.

PROMPT DELIVERY

Hold positive hole location tolerances

ZIEGLER TOOLS

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SIZES and types to fit all machines used for tapping and reaming.

W. M. ZIEGLER TOOL CO.

ROLLER DRIVE FLOATING TOOL HOLDERS 13570 Auburn Detroit 23, Michigan

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EACH Severance CARBIDE HAND FILE SAVES US $30.00 A WEEK!*
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MANY SPECIAL APPLICATIONS IN USE
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CAN BE RESHARPENED MANY TIMES
AN $8.00 RESHARPENING WILL OUTLAST APPROXIMATELY 150 ORDINARY STEEL HAND FILES
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MICRO-MILLS & BORE-MILLS
BALL BEAR REAMERS

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For torqueing problems USE the

New

"TITANTORKER" controlled TORQUE DRIVER

"TITANTORKER" makes controlled power torque available for a variety of torque uses—at low cost.

When desired torque is reached an audible signal is given as the internal driving balls are forced out of their sockets and overrun.

EASY ADJUSTMENT—For increased or decreased torque, "TITANTORKER" can be simply adjusted with an Allen wrench.

"TITANTORKER" can be used with any motive power except impact wrenches. Is ideal for most controlled power torque probems due to ease of adjustment and maintenance.

Available in 4 sizes in maximum torques from 75" lb. to 225' lb., with Female Adapters in driving head and Male Adapters on torque base.

Write for details and prices

TITAN TOOLS

World's Largest Producers Of Stud Drivers And Pullers

TITAN TOOL CO.

44 MAIN St., FAIRVIEW (ERIE COUNTY), PA.

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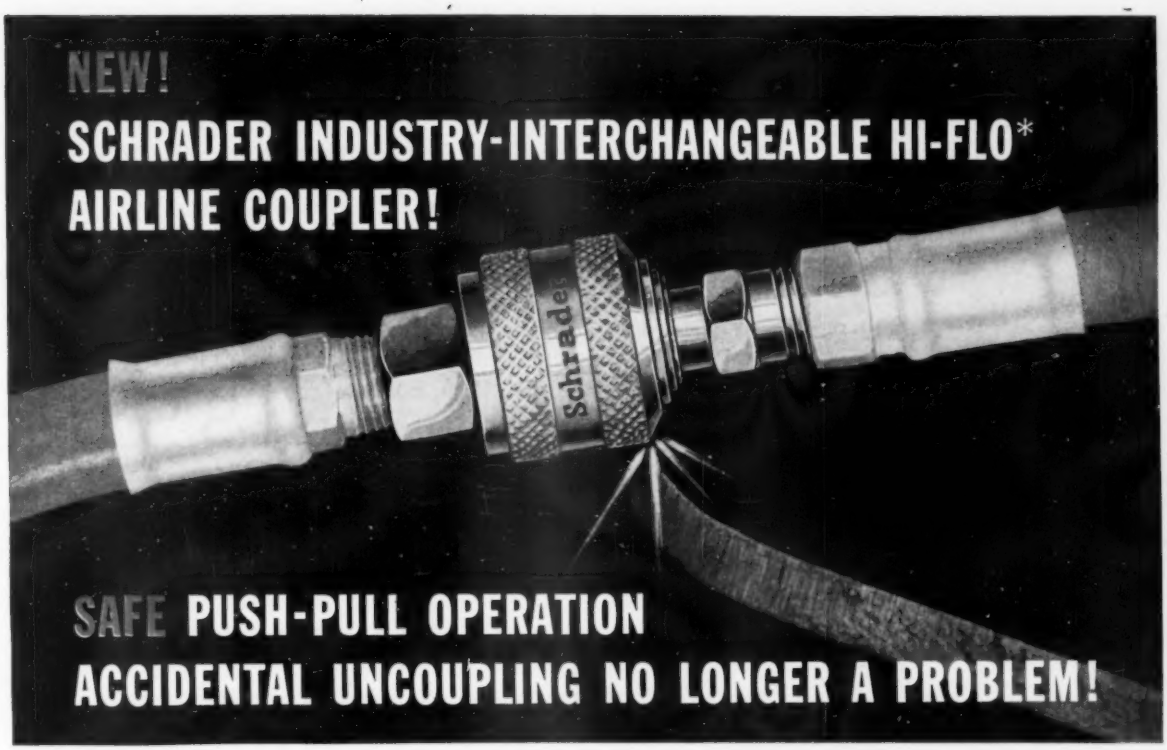
NEW!

SCHRADER INDUSTRY-INTERCHANGEABLE HI-FLO* AIRLINE COUPLER!



SAFE PUSH-PULL OPERATION
ACCIDENTAL UNCOUPLING NO LONGER A PROBLEM!

Schrader's new quick-acting couplers are full of features that afford the best air service. Safety's built in . . . it won't open accidentally even when dragged on the ground and snarled on a piece of machinery . . . yet the heavily knurled new coupler connects and disconnects in a single upstream push or pull with *one hand, gloved or greasy!*

More features: fastest air flow . . . non-corrosive . . . case hardened steel all through . . . meets and exceeds military specs . . . engineered for simple, easy replacement of parts in the field.

Important: Schrader's new coupler is interchangeable with others of similar type. A variety of end fitting styles are available. See your supplier soon.

NEW COUPLER CHECK UNITS AND ADAPTERS

#5139-12–¼ N.P. FEMALE

#5138-12–¼ N.P. MALE
#5140-12–¼ N.P. MALE

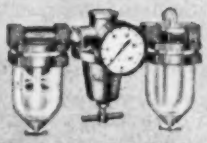
#5138-11–¼ N.P. MALE

#5139-11–¼ N.P. FEMALE

#5140-11–SERRATED SHANK FOR ⅜ I.D. HOSE

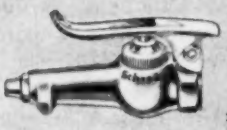
. . . added to these quality Schrader Accessories

SCHRADER HOSE REELS work like window shades. Tuck hose away automatically. No. 3481 is Air Tool Suspension Type.



SCHRADER LUB-AIR-ATOR does 3-way job: filters, lubricates, regulates. Keeps systems operating smoothly.

SCHRADER STANDARD COUPLERS WITH FASTER FLOW are now being shipped.



SCHRADER LEVER TYPE BLOW GUN offers precision control, from a gentle puff to a full blast.

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QUALITY AIR CONTROL PRODUCTS

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For utmost accuracy and versatility

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Combines a series of different measuring instruments

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This newest instrument enables you to handle the most varied problems with the greatest ease. Measurements can be made in plane rectangular and polar coordinates as well as in three-space rectangular and cylindrical coordinates.

The instrument embodies high precision glass scales and circles which can be read respectively to .00005 inch and 1′ of arc. By means of a new beam-splitting device, line and center symmetrical measurements can be made by a single or double reversed image in complementary colors. Certainty of setting is thereby greatly increased, and extremely difficult precision parts can be checked in far shorter time, with higher accuracy than ever before.

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Inclined binocular tube affords most comfortable viewing. Push-button control automatically projects the specimen image and all scales into binocular tube. Offers many other features such as comparison drawing device, projection and photographic attachments, etc.

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NOW 7* STANDARD LAPMASTERS

FOR PRECISION LAPPING

to a flatness of .0000116" or less with a micro-inch finish of 2 to 3 RMS. All Lapmasters will maintain this uniform accuracy piece-after-piece because conditioning rings continually condition the lap plate during entire lapping cycle.

IN SMALL LOTS OR THOUSANDS PER DAY

with consistent accuracy. Production is not interrupted or slowed down for replacing or reconditioning lap plates.

OF PARTS UP TO 32" DIA.

and as small as ⅛" dia. Accurately laps paper-thin pieces as well as giant two-ton parts.

OF ANY SHAPE, FORM OR MATERIAL

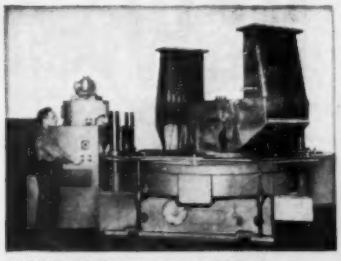
tall or squat, long or short, flat or odd shaped . . . any metal, ceramics or plastic all at the same time if necessary. Inexpensive work holders eliminate danger of stresses and warping usually caused by clamping during grinding or milling.

**For your special lapping requirements, we will build Lapmasters any size.*

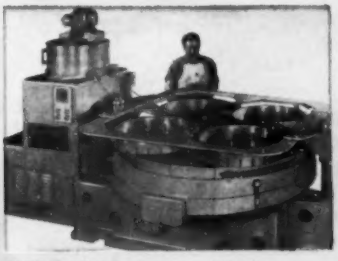
MODEL 10 for maintenance lapping of parts up to 3-11/16" dia.

MODEL 12 for parts up to 4" dia.

MODEL 24 for parts up to 9½" dia.



MODEL 84 for parts up to 32" dia.



MODEL 72 for parts up to 27" dia.

MODEL 36 for parts up to 14½" dia.

WRITE FOR THE COMPLETE LAPMASTER STORY

Write for bulletins describing the Lapmaster line and chart on measuring flatness.

MODEL 48 for parts up to 17" dia.

Lapmaster®

. . . THE MACHINE THAT PUT PRECISION LAPPING ON A PRODUCTION BASIS

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GILDEMEISTER drum type turret lathe

RV 63

A unique Machine Tool, the GILDEMEISTER DRUM TURRET LATHE is ACCURATE — FAST — VERSATILE AND SIMPLE TO OPERATE

16 tool stations disposed RADIALLY about a HORIZONTAL AXIS achieve previously impossible rigidity and resultant accuracy.

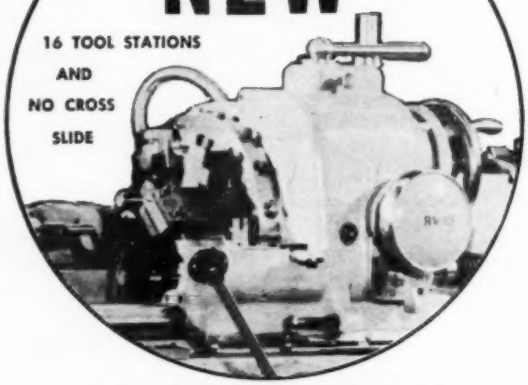
With a maximum swing of 27-1/16 inches and maximum distance between tool and chuck of 28⅝ inches, GILDEMEISTER combines speeds up to 2000 rpm, infinitely variable feeds to 0.031 in/min and a 13.6 hp motor.

The GILDEMEISTER DRUM TURRET LATHES also offer PROGRAM CONTROLLED PRESELECTION OF

- longitudinal feeds
- rotational direction
- spindle speeds
- rotational feeds

NEW

16 TOOL STATIONS AND NO CROSS SLIDE



THE GILDEMEISTER DRUM TYPE TURRET LATHES cut-off, undercut and relieve, by the accurate eccentric rotation of the HORIZONTAL AXIS turret. In this way unprecedented speeds and accuracies are maintained.

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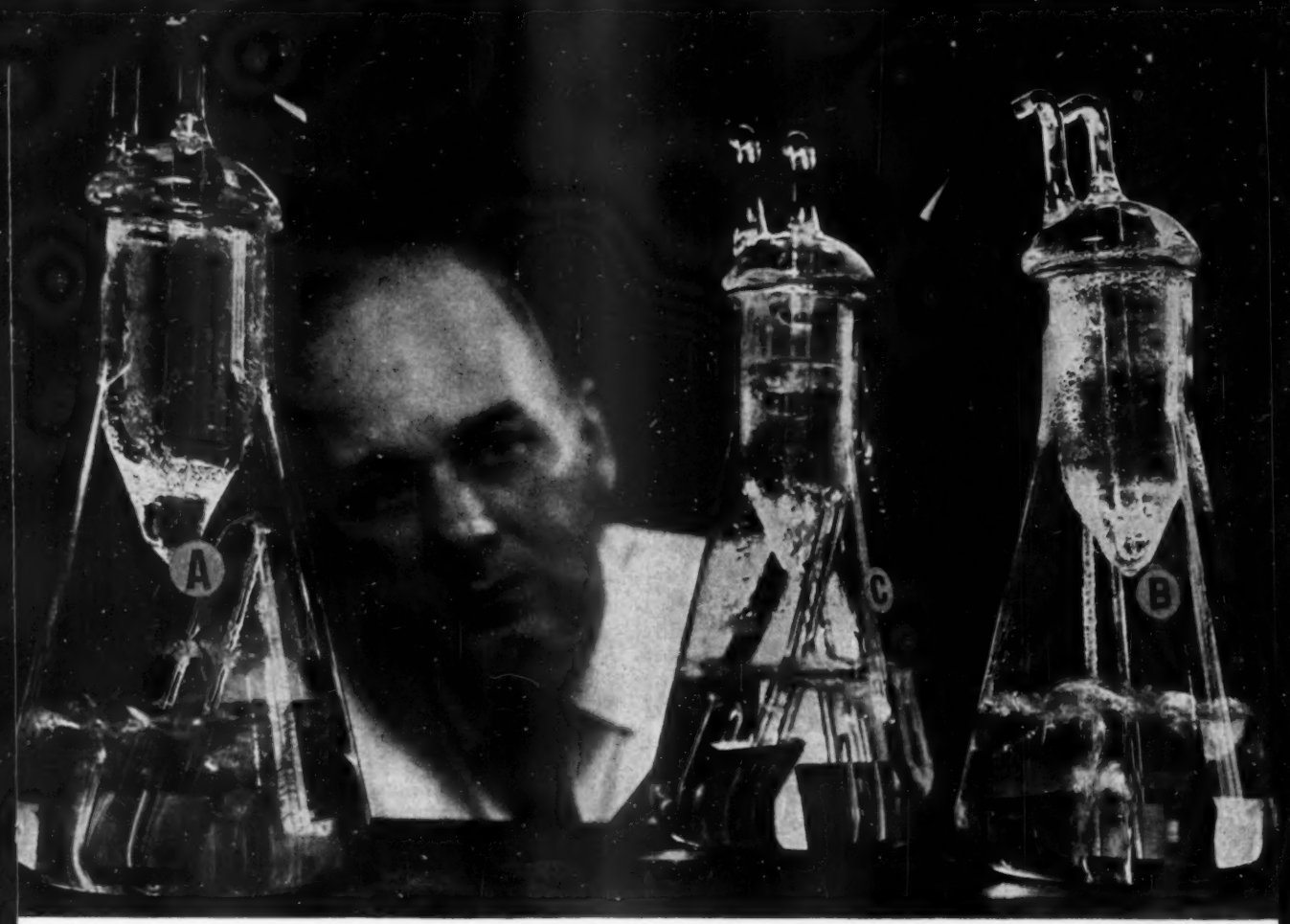

Here, boiling nitric acid is used to evaluate the corrosion resistance of Jessop stainless steel plate.

"How Jessop Tests Stainless Steel in Boiling Nitric Acid"

L. W. Cooper, Chief Metallurgist

"From experience, our customers know this is a fact: Specify Jessop for specialty steels . . . and then relax! Of the many reasons *why* this is true, here's one . . .

"In evaluating corrosion resistance, one of the procedures we use is the ASTM boiling nitric acid test. Standard and simple? Yes. But expert *evaluation* is of great importance to the customer. That's why, at Jessop, a top metallurgist closely supervises each of the five 48-hour test periods.

"*Overly cautious?* Because we're overly cautious in *every* phase of steel production and quality control, Jessop has earned the reputation for producing specialty steels tailor-made to the most exacting specs—*Specify Jessop . . . and then relax!*"

Checking the grain size of tool steel, this Jessop metallurgist uses a microscope with a camera attachment. VMA 6787

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STEEL COMPANY
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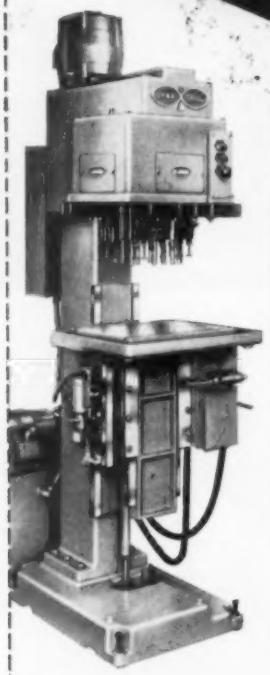
. . . save 50% on capital outlay costs!



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- Fully automatic drilling or tapping cycle with push button controls! Up to 14 spindles available!
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- Drills or taps 40,000 holes per hour — floor to floor time!

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RUGGED CONSTRUCTION of Deka-Drill features heavily ribbed castings — will give years of trouble-free service.

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HYDRAULIC LIFT — *a Deka-Drill exclusive*—easily positions the knee and table over a full 14 inches!

HYDRAULIC MODEL H712

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with motor and controls F.O.B. Factory

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MANUAL MODEL M712 **$1998.50** with motor and controls F.O.B. Factory

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12 oz. aerosol spray can

For positive, long-term protection of . . .

- *dies • tools • jigs*
- *machinery • fixtures*
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Fog-Maker dispenser

Rust-Lick 606 is a fast, economical method of rust prevention. Specially developed for spray-on application, it is quickly and easily applied to wet or dry surfaces. It produces a thin oily film after evaporation of the high flash solvent component. The residual film is non-drying, providing long-term protection against rust.

Available in 12 oz. aerosol spray cans; 2 and 5 gallon drums with Fog-Maker dispenser; and 30 and 55 gallon drums with spray gun and CO_2 cartridges.

Used and recommended by leading manufacturers and metal fabricators. Be safe. Get positive rust protection. Get Rust-Lick. Order from your local industrial supplier.

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Take a Critical Look

at the design of your Gear Shaving Machines

In today's competitive economy, it is imperative to scrutinize each production machine from the standpoint of operating costs. Just what does it contribute? What does it cost to operate? How does its design affect its operating economy? These questions suggest other more specific questions in the case of gear shaving machines:

CHIPS

- Are the cutters of your machines so located that chips fall away from them rather than into them?

LOADING HAZARD

- If, while loading, a work gear accidentally slips from the operator's fingers will it fall into the cutter teeth?

GRAVITY

- Is cutting pressure applied downward, taking advantage of gravity or upward, unpredictably taking up the operating clearance of the table ways?

AUTOMATION

- Are the extra components needed to automate the machine, in the way when the cutter is changed?

RIGIDITY

- Does the single solid cast column provide more rigidity than one made up of bolted sections?
- Is a deep massive table assembly held in position by gravity more rigid than a shallower, lighter assembly hung from above?

OBSTACLES

- Are there any projections above table level to interfere with the operator's movements as he loads a work piece or changes the cutter?

FEED

- Is the automatic feed mechanically positive and consistently precise?

To check your answers to these pertinent questions, call your Red Ring representative and suggest he bring along Bulletins AP 57-11 and S-57-2—All in the interest of ECONOMY.

SPUR AND HELICAL GEAR SPECIALISTS
ORIGINATORS OF ROTARY SHAVING,
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WORLD'S LARGEST PRODUCER OF GEAR SHAVING EQUIPMENT

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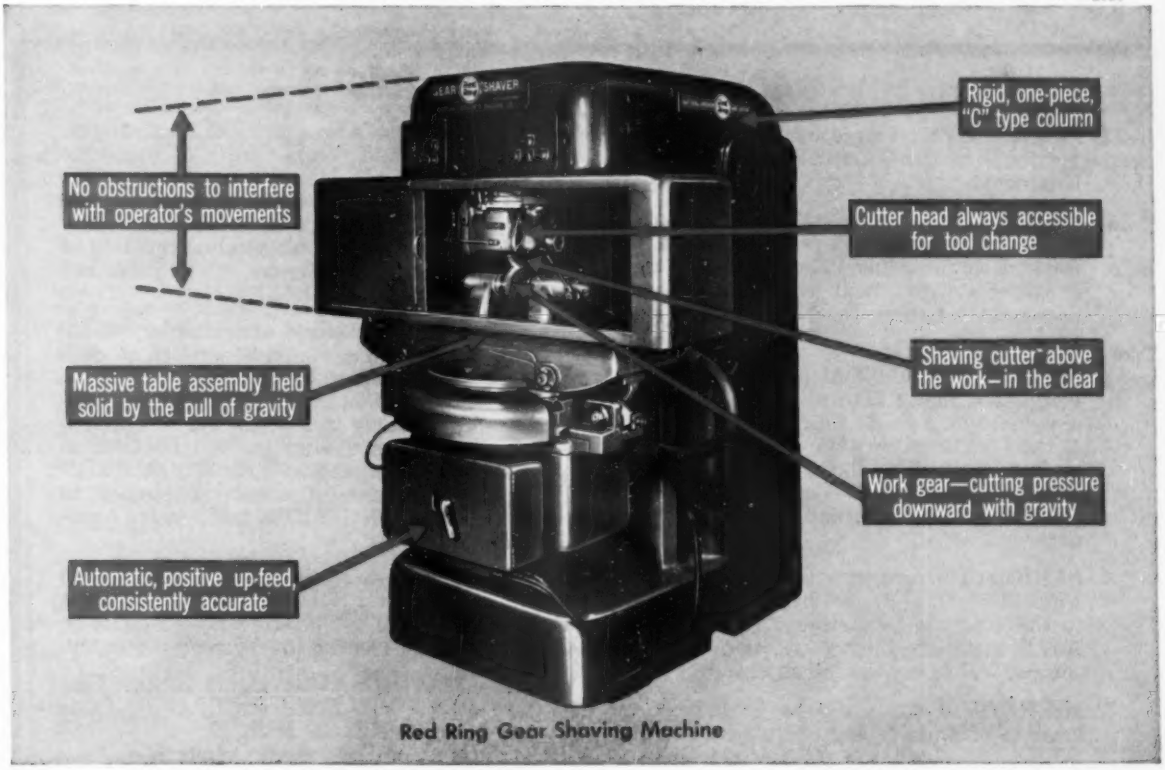
No obstructions to interfere with operator's movements
Massive table assembly held solid by the pull of gravity
Automatic, positive up-feed, consistently accurate
Rigid, one-piece, "C" type column
Cutter head always accessible for tool change
Shaving cutter above the work—in the clear
Work gear—cutting pressure downward with gravity

Red Ring Gear Shaving Machine

GADGETS CONTEST

If you've thought up an interesting device that makes toolroom or production jobs easier, safer or more efficient, get it ready for the Gadgets Contest, beginning October 1.

Entries for the contest will contain ideas that are real practical value to tool engineers. They are ideas you won't find in any handbook, but they are valuable contributions to America's productive knowhow.

Take a look at the Gadgets in the Gadgets Section of any issue of THE TOOL ENGINEER. They are typical of the sort of idea we are talking about.

Then sharpen your pencil and get to work. Write a brief description of your Gadget, make a sketch and get your gadget ready to send along. You may win one of the seven cash prizes and you'll have the satisfaction of knowing that your idea may be real value to fellow tool engineers.

GADGETS CONTEST RULES

1. **ELIGIBILITY:** This contest is open to all members of the American Society of Tool Engineers.
2. **DEFINITION:** "Gadgets" are defined as tools or methods developed to solve specific production problems. They should contain a useful and practical idea or indicate an ingenious solution to a tool engineering problem.
3. **PRIZES:** One $100 first prize, two $50 second prizes, four $25 third prizes, and honorable mention awards which will be a choice of the Tool Engineers Handbook, 2d Edition, or Die Design Handbook published by the American Society of Tool Engineers. Certificates will be awarded to all prize winners.
4. **PERIOD:** The contest will run from October 1 until December 31, 1959. All contributions to the Gadgets Department received from ASTE members during the period of the contest will be considered as entries.
5. **JUDGING:** Entries will be judged on the basis of originality and usefulness to other tool engineers. Also, clarity of illustrations, conciseness and completeness of presentation will be considered. Members of the ASTE National Editorial Committee will serve as judges. Winners will be notified by mail as soon as possible after completion of judging. A list of winners will be published in THE TOOL ENGINEER.
6. **ENTRIES:** The name and chapter affiliation of the author should be written on each page of the entry. No entries will be returned. Information which has been published previously in a periodical or national magazine is not eligible. All publication rights are assigned to THE TOOL ENGINEER. Authors of entries published in THE TOOL ENGINEER will receive honorariums.
7. **LENGTH:** Entries should be limited to 500 words or less. Sketches or photographs should be used to illustrate the methods or devices described in the text of the entry.
8. **MAIL ENTRIES TO:** Gadgets Contest Editor, THE TOOL ENGINEER, 10700 Puritan Ave., Detroit 38, Mich.

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This informative Handbook was upgraded to fit *your* needs. Answers to your tool engineering problems are provided. It will help you make correct decisions regarding:

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- Work Setup: Jigs & Fixtures
- Economics
- Material Handling
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- Supporting Theory, Mathematics, Mechanics

Gives More Information

The 2nd edition provides more *new* information than the first edition. A total of 219 additional pages have been added.
The Handbook contains 103 sections—99 sections have been upgraded and 4 sections have been added. These four completely *new* sections describe "Organization for Manufacturing"; "Applied Principles of Automation"; "Electromachining Process"; and "Coordination Equipment."

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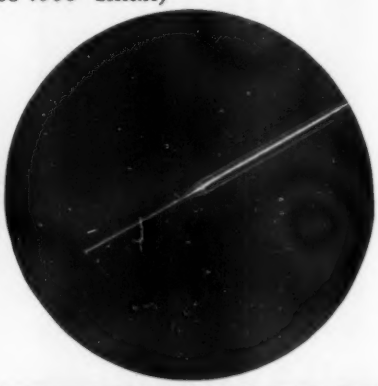

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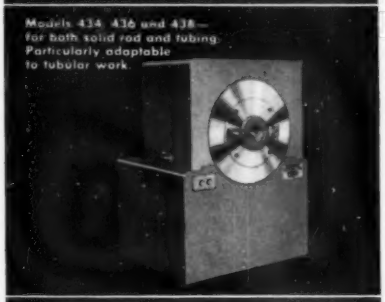

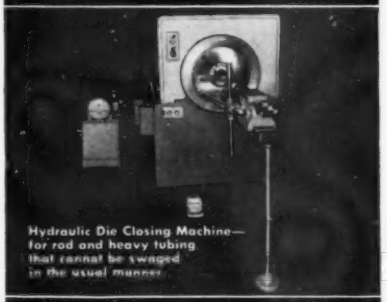

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ADVANTAGES OF THE MOHAWK SIZE-OPTIONAL SYSTEM

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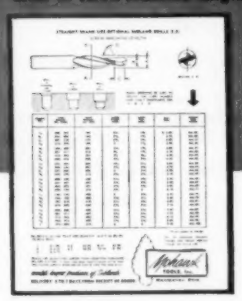

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- *"Chip curl" influences cooling action of cutting fluids. . .*
- *A fluid can be* too good *a coolant. . .*
- *Fine-finish benefits of cutting fluid are controlled by tool temperature.*

These and other previously unknown facts are discussed in detail in ASTE Research Report #19, "The Cooling Characteristics of Cutting Fluids," just published by the American Society of Tool Engineers' Research Fund. The Report is available to ASTE members at a cost of $.75 each and to non-members at $1.50. Orders should be addressed to ASTE Research Fund Director, 10700 Puritan Avenue, Detroit 38, Michigan.

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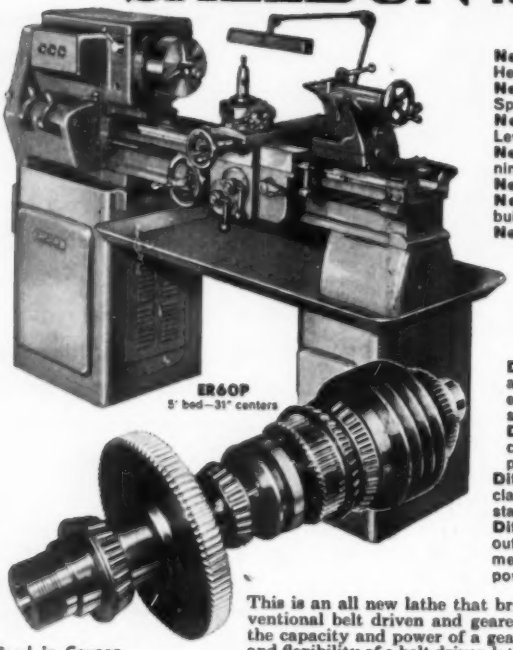

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New. 1½" Hole through Spindle.
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Different. Two independent clutches in apron for selecting power feeds.
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Different. Triple, cogged, V-belt outboard drive—eliminates intermediate shafts—delivers more power to spindle.

This is an all new lathe that bridges the gap between conventional belt driven and geared head lathes. It combines the capacity and power of a geared head with the economy and flexibility of a belt driven lathe. Available with 5', 6' and 8' bed lengths providing 31", 42" and 66" center distances.

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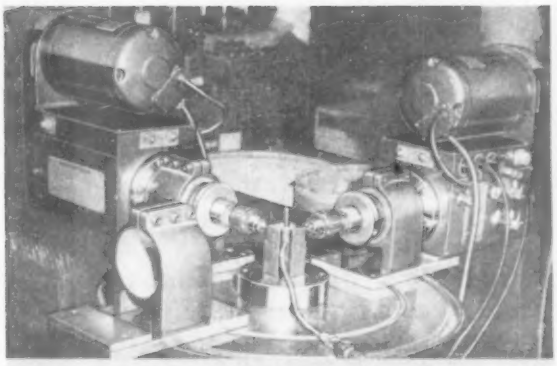

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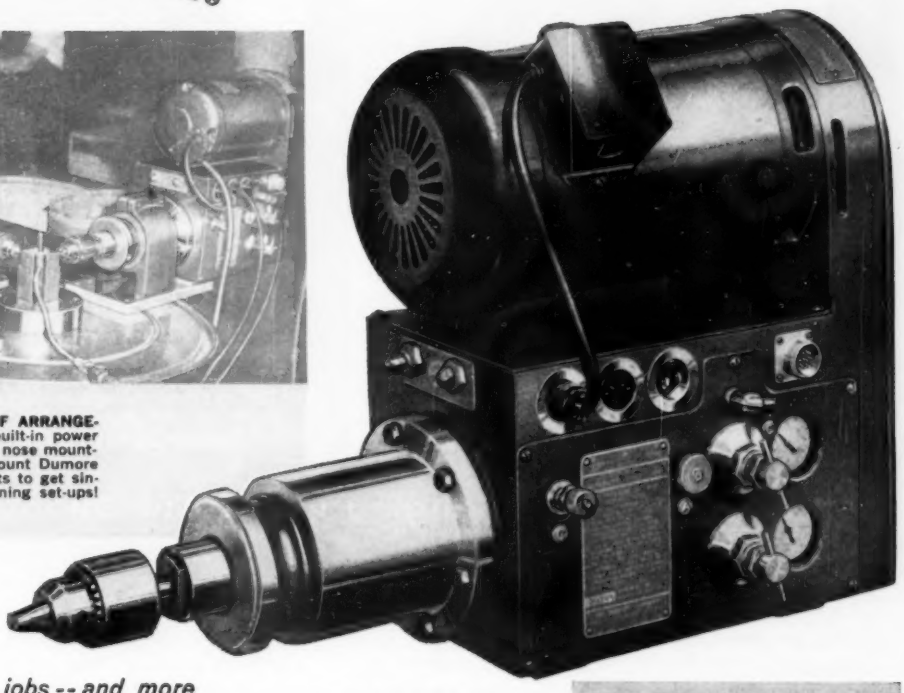

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Low first cost. Low operating cost. You benefit on high or low production runs. Simple design, unique mounting, and self-contained adjustable feed and speed controls permit *quick* changeover from job to job—eliminates expensive idleness of high-cost special machines.

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SEE YOUR LOCAL DUMORE INDUSTRIAL SUPPLY DISTRIBUTOR, NOW

. . . for a demonstration at your own shop, if you like. He'll be glad to show you sample set-ups, too. 3 models to choose from, priced from $418 FOB Racine, complete with all components including motor, ready to operate. Ask him to show you the wide range of accessories available.

Want more details? -- **SEND COUPON**

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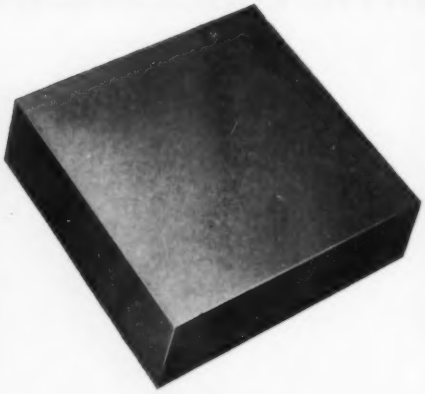
WHY BUY METAL YOU DON'T USE?

Switch to Allegheny Ludlum Cast-to-Shape Tools



FORGING

1250 lb. block, with 150 hours of machine time costing $1000, is necessary to fabricate die retainer.

CAST-TO-SHAPE

Cast-to-shape die retainer to hold automobile horn die weighs only 650 lbs., a $250 savings.

$1250 saved by changing to Cast-to-Shape tool steel

Paying for metal that ends up chips on the floor is a costly proposition these cost-conscious days. Here are two good reasons why you should switch your tool-making to Allegheny Ludlum cast-to-shape tools.

CAST-TO-SHAPE MEANS YOU BUY FEWER POUNDS OF METAL.
For example the manufacturer of automobile horns above saved 600 pounds of expensive alloy steel by specifying a cast-to-shape die retainer instead of fabricating it from a forged block. Result? A savings of $250, including the slight pattern cost.

CAST-TO-SHAPE MEANS LESS FINISH MACHINING.
To machine a retainer from the block above would have taken 150 hours of machine time at a cost of more than $1000. The Cast-to-Shape retainer is within ¼ to ⅜ inch of *finished* size, requiring only a *slight* roughing and finishing operation.

Allegheny Ludlum, a tool steel producer who makes cast-to-shape tools, casts them with the same precise quality control for which their tool steels is known. A full line of cast-to-shape tool steel grades is available. You'll find ones with high resistance to abrasion, compressive strengths of approximately 400,000 psi, easy machinability, hardening with almost no distortion, toughness, high red hardness, and the capacity to take a high polish.

Find out now how you can cut costs on your complex tools. Write for FC-4, a 28-page technical discussion of A-L's Forging and Casting Division with applications, pattern information, design tips, analyses, and heat treating instructions. Or call your nearest A-L tool steel warehouse or distributor.
ALLEGHENY LUDLUM STEEL CORPORATION, OLIVER BUILDING, PITTSBURGH 22, PENNA.
Write to Dept. TE-23.

7278

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Tool Steel warehouse stocks throughout the country . . . Check the yellow pages

EVERY GRADE OF TOOL STEEL . . . EVERY HELP IN USING IT

TO THOSE CONCERNED WITH PRECISION MEASUREMENT

DoALL introduces superior gage blocks of stainless steel

The DoALL Company is proud to report the successful completion of a development program to adapt the superior qualities of stainless steel to gage blocks. Stainless steel gage blocks have been tested by actual use not only in our own machine tool factories but in the plants of leading gage-using industries throughout the country. Calibration and inspection of blocks in use for many months overwhelmingly confirm initial laboratory findings regarding the exceptional properties of the new blocks.

Durability. Having a greater hardness (Rockwell C 68 to 70), they are far less susceptible to nicking, burring and wear than steel blocks. Periodic checks of both steel and the new stainless steel blocks under identical extended use conditions in machine shop inspection show a 4 to 1 ratio in favor of the new stainless steel gage blocks.

Corrosion Resistance. Of 201 stainless steel blocks used in shop inspection for one year without receiving any protection against corrosion, only one block in five showed traces of corrosion at the last inspection, while four out of five, or four times as many, steel blocks used under identical conditions suffered corrosion damage in the same period.

Stability. Metallurgical structure of the stainless steel block would indicate complete stability. Periodic calibration of shelf-stored blocks over a period of more than one year in our laboratories, and for extended periods by independent laboratories, discloses no significant change in dimension with time.

Thermal Coefficient. DoALL stainless steel gage blocks expand 5.75 millionths of an inch per inch of length for each Fahrenheit degree rise in temperature in the range of normal shop temperatures. Since the thermal coefficient of AISI-SAE production steels range from 5.5 upward, no compensation is necessary in making shop measurements with DoALL stainless steel blocks.

Surface Finish. The nearly perfect optical finish of DoALL Stainless Steel gage blocks exceeds even the .09 AA finish of DoALL Tool Steel blocks. Such a finish is essential to ultra precise evaluation by interferometry. Where the new blocks are used as shop standards superior finish provides wringing accuracy and increased life.

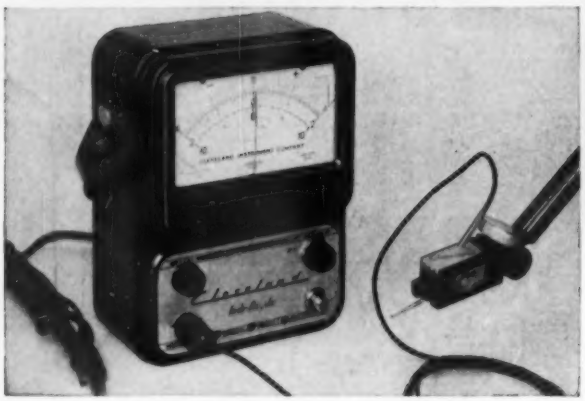
Wringing Characteristics. The extremely hard, optically-smooth gaging surfaces of DoALL SS gage blocks slip together easily, wringing out air and moisture to form a micro accurate combination. Because of their resistance to corrosion, the new blocks can be left in combination indefinitely without damage to gaging surfaces.

Availability. DoALL Stainless Steel gage blocks are made in all decimal sizes from .050000″ to 4.000000″ and in fractional sizes from 1/8″ to 1/4″. Accuracies are AA, plus .000002″, minus .000002″ and A+, plus .000004″, minus .000002″. They are offered in standard sets of 38, 81, 83, 84 and 86 pieces.

Recommendation. If you use gage blocks, this new development merits your investigation. Call your local DoALL Store or write:

The DoALL Company, Des Plaines, Illinois

NOW HIGH PRECISION FOR EVERY SHOP AREA



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Two NEW Booklets on AUTOMATIC TRACING

Many jobs ticketed for numerical control can be done at much lower cost by the methods and machines described in these booklets. Close tolerances can be easily maintained at production speeds. Ask for Booklets No. 2968 and 2972.

YOURS FOR THE ASKING ON LETTERHEAD REQUEST

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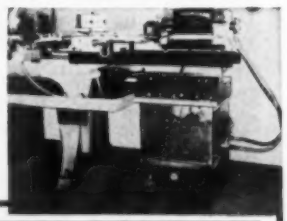

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Cylinder before expanding, 15" dia., 16" long. Mtl., mild steel, .050" thick. After expanding, dia. at flanges, 19", lgth., 12".

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Grotnes Expanders, with low cost tooling, close tolerances, high production rates, cold form parts ranging from 4" to 100" in diameter, 1 inch to 15 feet in height. Write for details.

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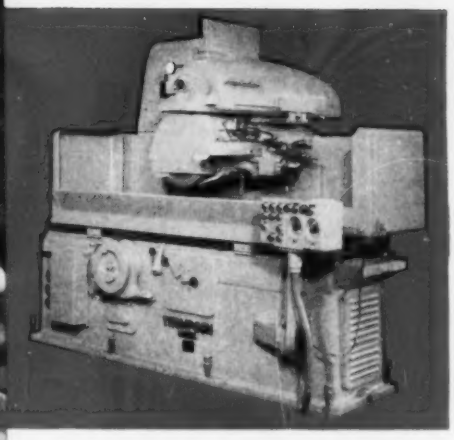
THE NEW THOMPSON PLUNGE-MATIC SURFACE GRINDER



COMPLETELY AUTOMATIC

With the new Plunge-Matic, Thompson now offers a plunge feed machine for those surface grinding jobs where the area to be ground is constantly covered by the grinding wheel width. Designed for fast production, the Plunge-Matic is completely automatic—including downfeed, wheel dressing and automatic compensation.

Shown above is one of four Plunge-Matics in use at the Disston Division, H. K. Porter Company, Inc., grinding high quality hand saws. The saws are held on tapered flux bars or magnetic shims and the wheel face is dressed straight with an automatic power operated wheel truing device. The four machines are equipped with a pre-selected variable downfeed arrangement which automatically decreases the downfeed rate as the contact area of the work increases. The wheel heads are also equipped with oscillating crossfeeds. Being completely automatic in their cycles, the four machines require but two operators who load and unload only.

Constant Accuracy is Assured by Hydra-Cool

All Thompson Plunge-Matics are made in various types and sizes to meet all job requirements. All machines of 40 inches and up in work length are equipped with the Hydra-Cool Hydraulic System*—the exclusive Thompson feature which eliminates all heat distortion throughout the machine.

* PAT. APPLIED FOR

Send for descriptive folder on this new Plunge-Matic surface grinder.

The new Thompson Plunge-Matics are designed to grind contoured as well as flat surfaces with equal efficiency. The three drawings at right represent but three of many contour jobs which Thompson Plunge-Matics are now handling successfully.

SPECIFICATIONS

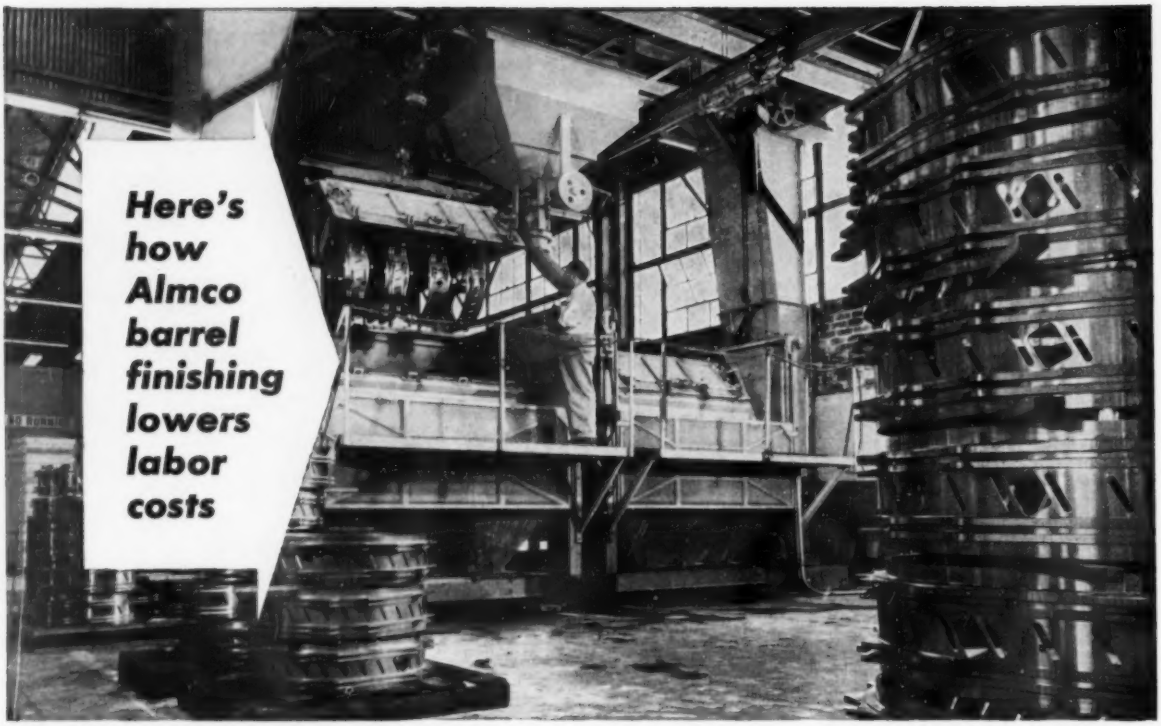
GRINDERS:	Thompson Type C 12"x16"x-48" Plunge-Matics
WHEELHEAD:	40 HP
WHEEL:	20"x8"x12"
STOCK REMOVAL:	Approx. .010" from each side
PRODUCTION RATE:	60 saws every 50 minutes from 2 machines with one operator

Thompson SURFACE GRINDERS

THE THOMPSON GRINDER CO.

SPRINGFIELD, OHIO

"Keep Thompson in mind for that daily grind"



Jet parts finished twenty-four times faster!

ALMCO Supersheen System
SUPERIOR MACHINES AND METHODS FOR FINISH BARREL FINISHING.

Fast, precise barrel finishing is a vital key to production of intermediate jet engine parts shown above. Made by Rheem Manufacturing Co., Downey, California, these forged and machined jet engine flanges are cleaned and deburred in custom designed ALMCO barrel finishing equipment prior to welding operations.

Four of the circular units are locked onto a fixture within the equipment. From a pit below, deburring and polishing materials are transferred *automatically* to an overhead hopper for recharging the barrel after work is in place.

In one hour, burrs are removed from all four parts and surfaces are thoroughly cleaned and polished. A preservative coating is also applied to the units at the end of the barrel finishing cycle.

Your sample parts processed without obligation in a modern Almco test lab. Complete free report includes recommendation. Send sample parts with specs required or write for details.

Manually, this deburring and cleaning work formerly required *six hours per unit!* Uniform processing of all projections and surfaces was difficult if not impossible!

This ALMCO installation is typical of problems solved by the machines and methods of an ALMCO *Supersheen* System. At ALMCO you get trained counsel with your finishing problems . . . *free* sample processing in a modern ALMCO lab . . . skilled guidance in selecting the proper standard or custom designed ALMCO unit. Write today on your letterhead asking for an ALMCO sales engineer to call. Or send parts direct to ALMCO's lab with specifications required.

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New brochures now ready on Almco Spindle Machine, Vibrasheen, other cost-saving units. Price list on Almco compounds and media included. Send for your Almco Album of New Products today!

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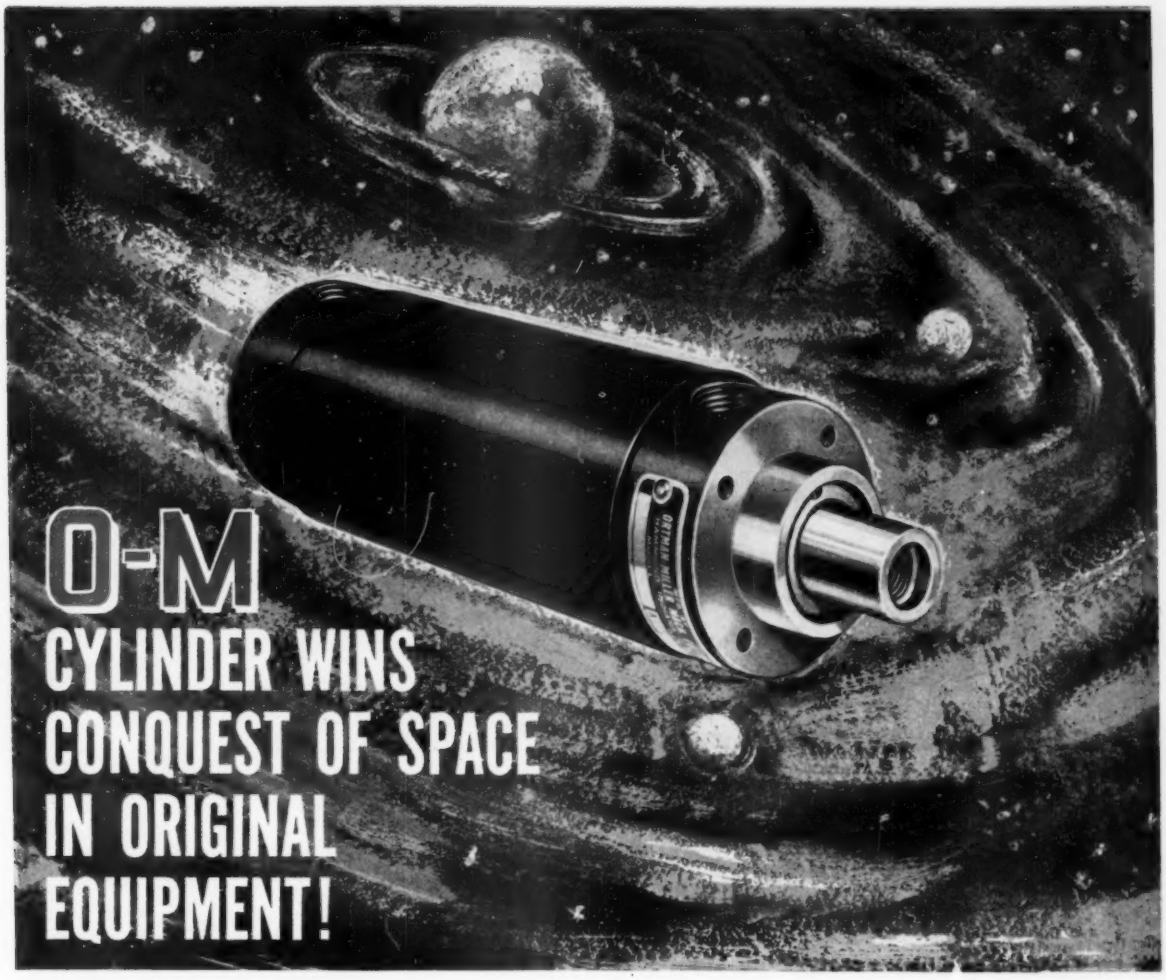

SERIES 101A

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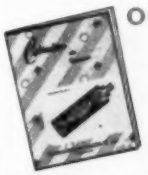
By fitting into one-third less space than a tie-rod cylinder of the same bore, this original O-M space-saving component gives greater flexibility to design, reduces weight and cuts installation time.

But there are many other reasons for using this O-M Round-line Cylinder that delivers smooth, dependable power. It has the lowest coefficient of friction . . . assures full-power starts . . . is sealed right—ports are easily oriented independently to 360 degrees...and, end plugs are tapped for universal mounting. Easily modified for special applications at a nominal extra over standard cylinder prices. Internal locking key makes it easy to disassemble, service and reassemble with no alignment problems.

Available for Air or Hydraulic circuits in a complete range of sizes (1½" to 8" bores) with standard, 2 to 1 or oversize rods. All-steel construction with bearing bronze. Completely interchangeable parts. Immediate delivery on many sizes.

Mail coupon at once for Bulletin 101A containing engineering drawings of cylinder, mounts, mounting brackets, capacity chart and other data.



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Harold Meyers, Meyers Machine Co., Grand Rapids, Mich.

VERIFIED ACCURACY — Before it leaves the factory each CLAUSING MILL must pass rigid tolerance tests such as:

1. **Top of table perpendicular to column ways within .0005" in 6" travel.**
2. **T-slots square with cross slide dovetails within .0005".**
3. **Table, parallel to turret within .001".**
4. **Spindle square with table, front to rear, within .001" T.I.R. in 5" circle.**
5. **Spindle taper (internal) runout within .0002" at spindle nose.**
6. **Table T-slots parallel to table dovetail ways within .0005" in 8" longitudinal travel.**

THE CLAUSING VERTICAL MILLER is a *precision machine tool* designed for general production milling . . . pattern, experimental and tool room use.

It has sensitivity you don't get in larger machines. That really pays off in accuracy and efficiency on *every* job using small cutters.

And, the Clausing is an outstanding producer – "most versatile, easiest to set up, get around and operate of any miller at or near its low price". Only $875 f.o.b. factory. See it before you buy *any* mill.

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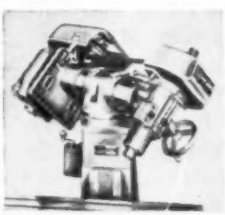

The spindle head can be swiveled in a vertical plane and set at any angle, and turret rotated in a horizontal plane making it possible to machine at all angles with one set-up.

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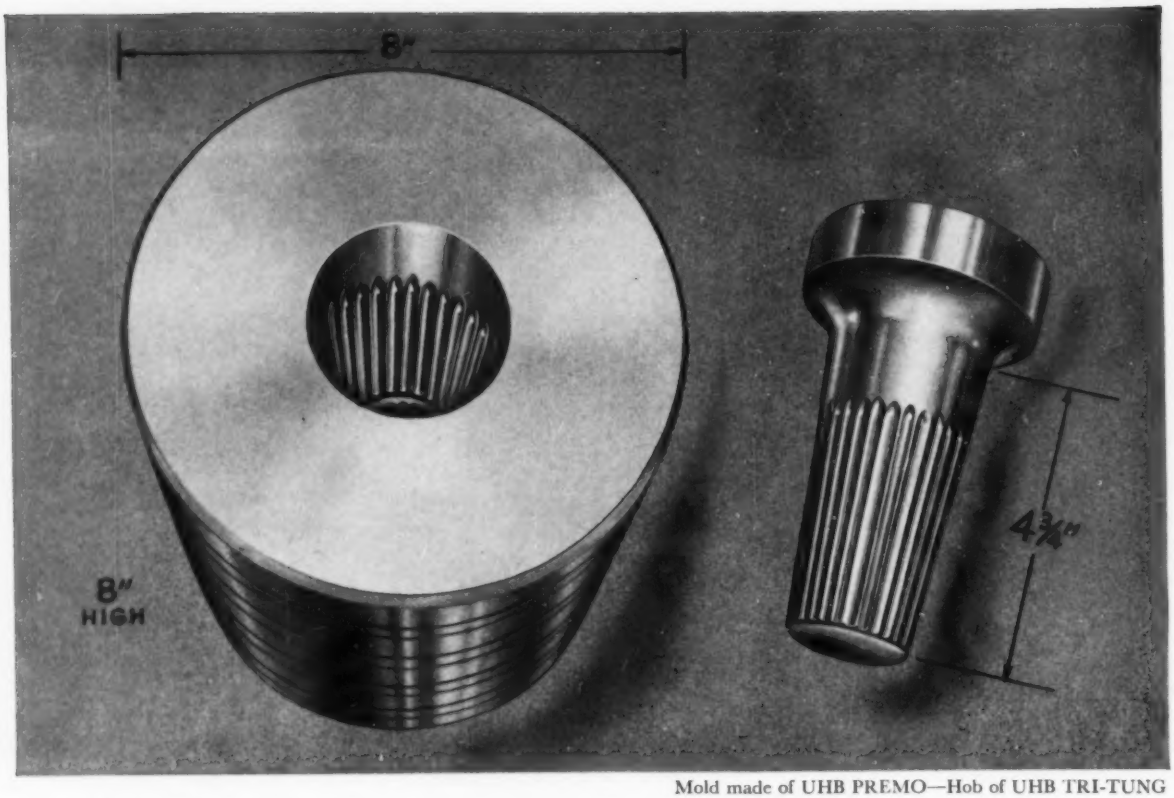

Mold made of UHB PREMO—Hob of UHB TRI-TUNG

This Plastic Mold Was Cold Hobbed Without Annealing!

This mold made from UHB PREMO, a 5% chrome-type plastic mold steel (SAE P4), is used for molding plastic containers (Polyvinyl Chloride).

Because UHB PREMO is extra low in carbon content, very soft in its annealed state, and has truly outstanding sinking properties, the hobbing of this mold was done in four stages with *no annealing between stages!*

When hardened and tempered, UHB PREMO has an excellent wear resistant case—a high core hardness, (Brinell 250-300 depending on size) which provides good resistance to sinking, and it also polishes to a mirror-like finish with a minimum of effort. The mold blank was approximately 8" high by 8" diameter—the cavity is 4-11/32" deep. Hobbing was done with ram speeds of 0.05" to 0.06" per minute.

This mold was cold hobbed with a hob made of UHB TRI-TUNG, a high-carbon, high-chrome steel (SAE D6). The hob was copper plated between stages and lubricated with "Molykote", (Molybdenum Disulfide powder and SAE 10 oil).

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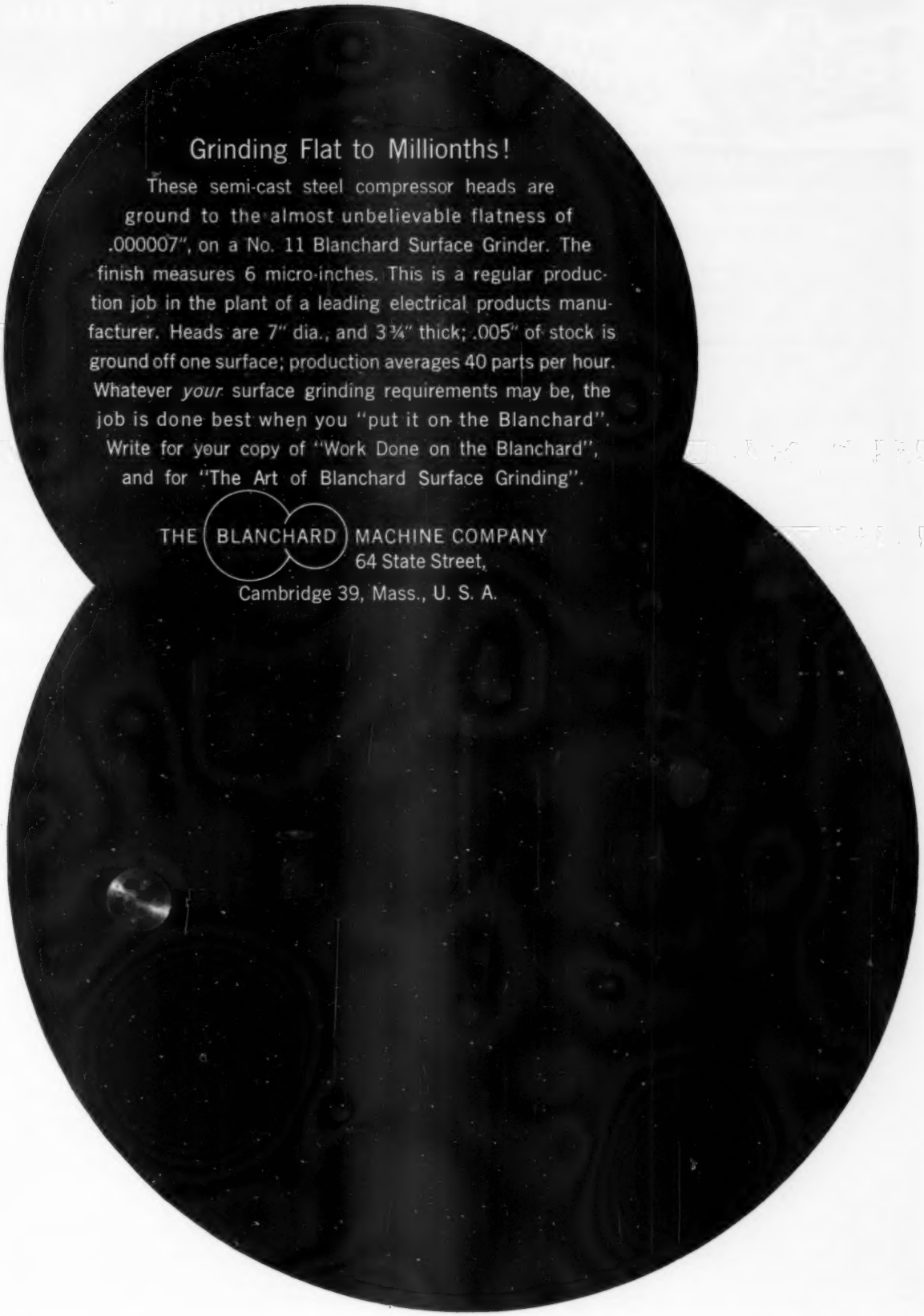

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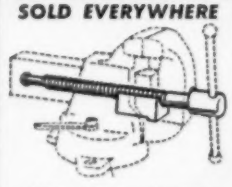

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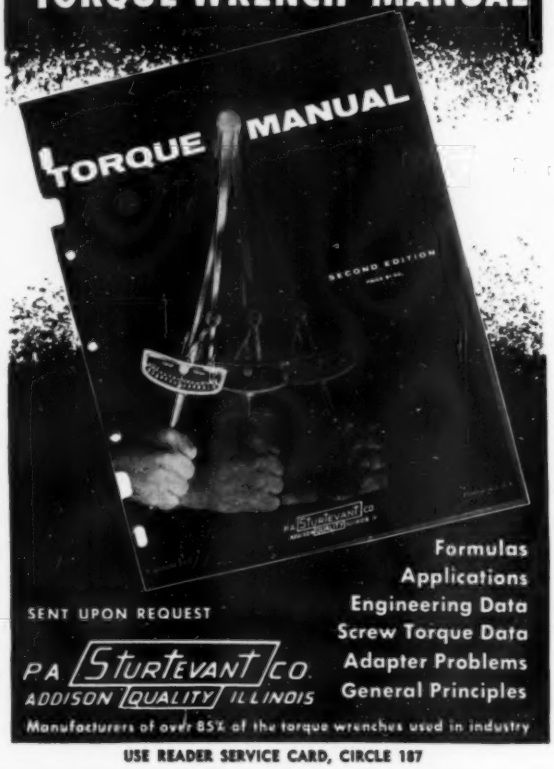

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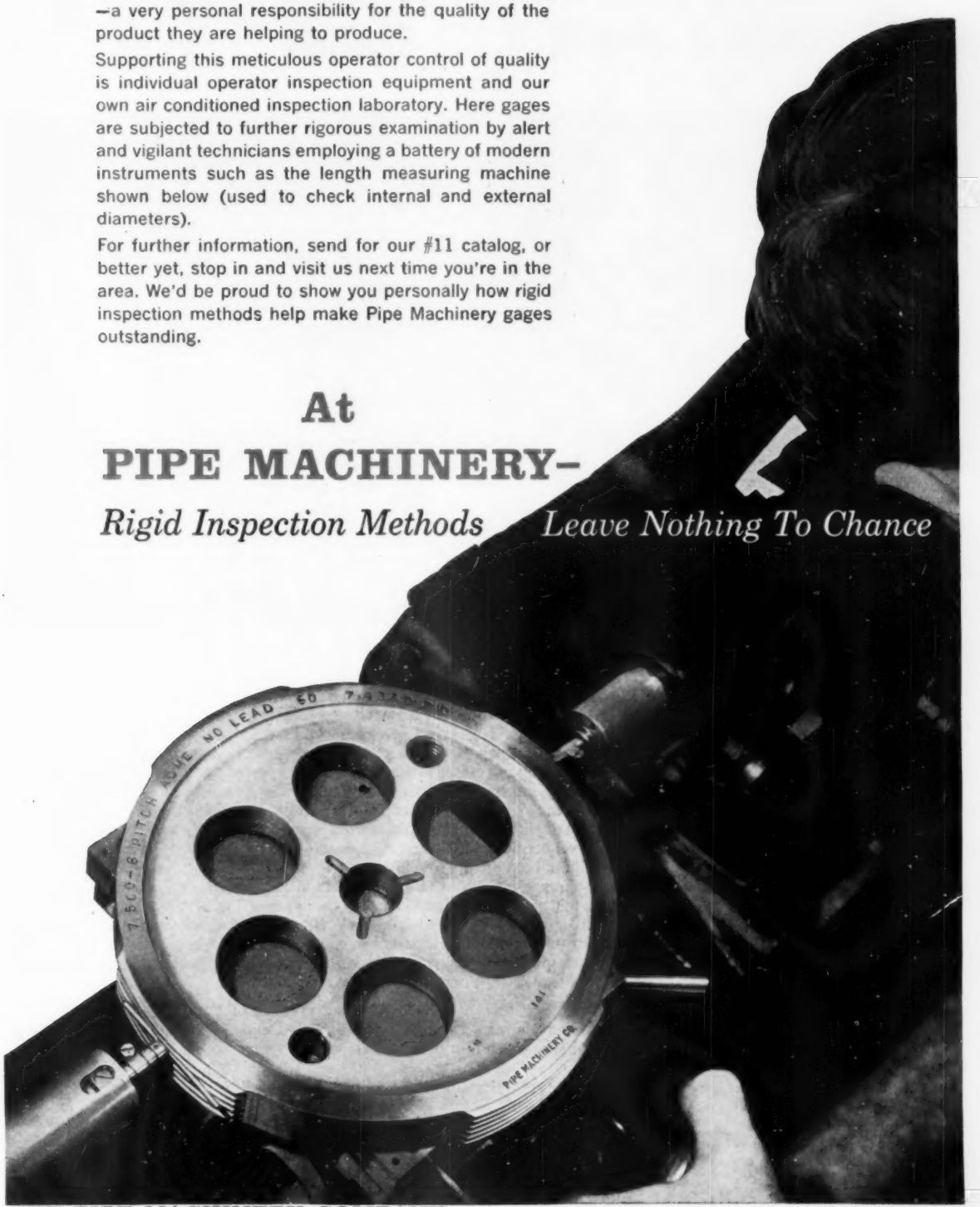

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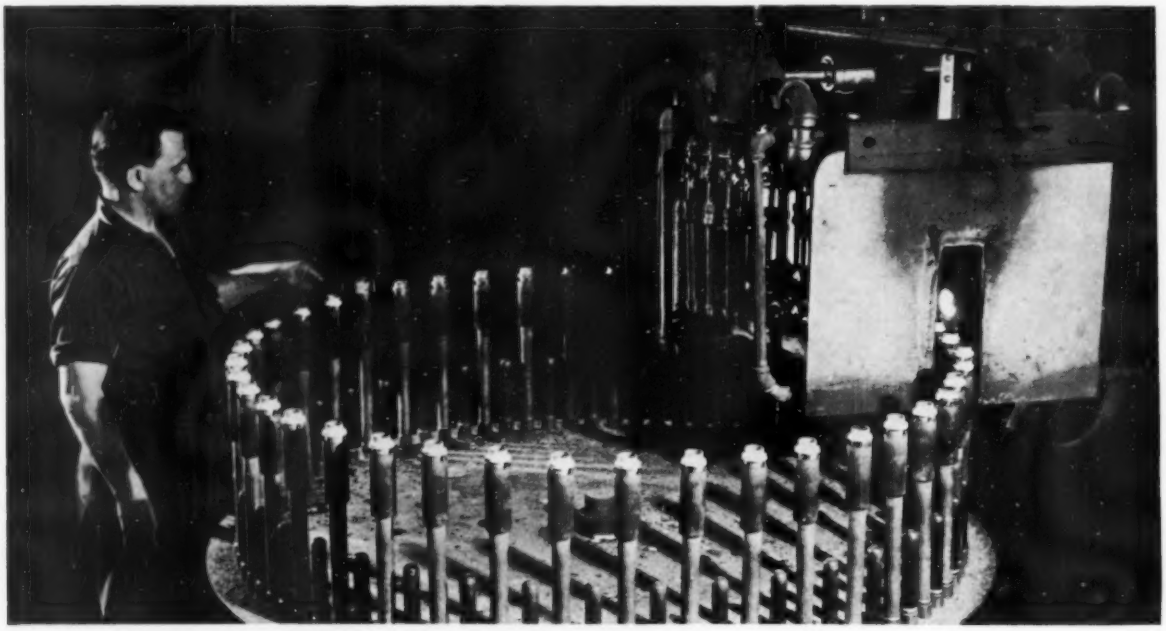

Rotating jig showing mounted assemblies entering and leaving gas-air furnace.

Left– brazed assembly. Right– components with preform ring of EASY-FLO *45.*

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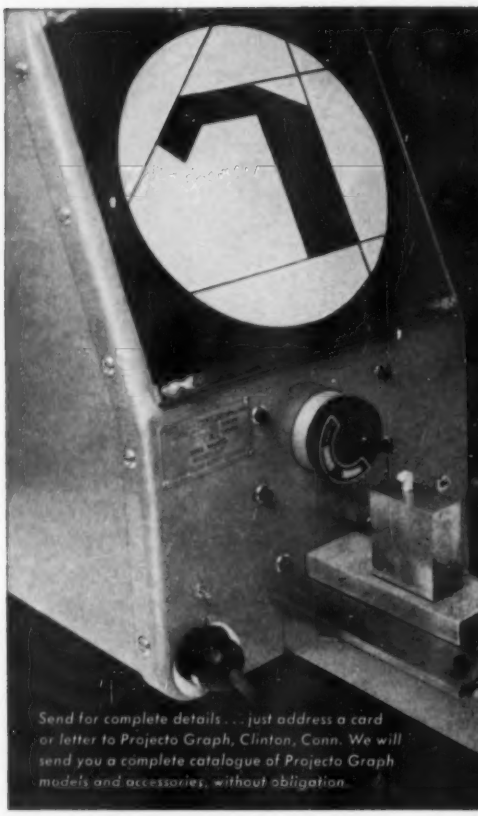

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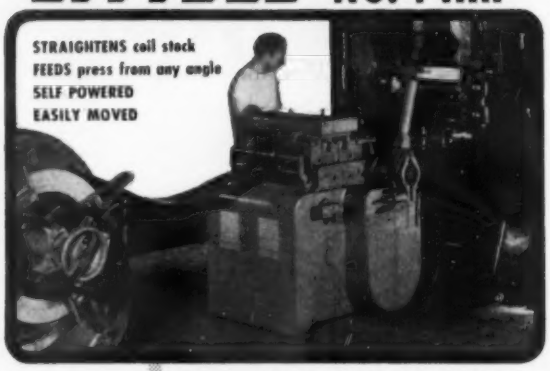

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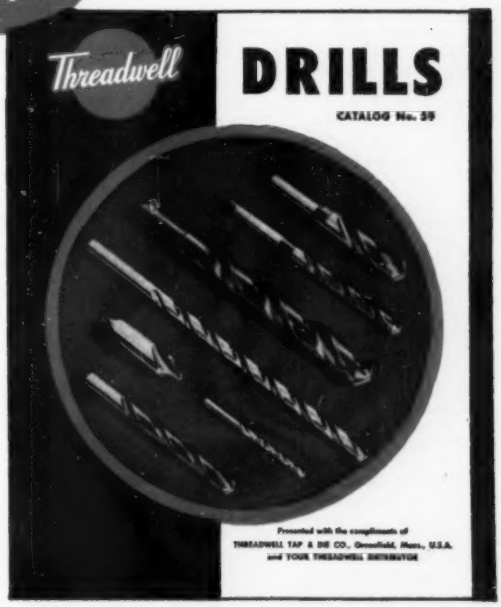

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November 1959

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LOOKING AHEAD

By T. W. Black
Senior Associate Editor

Speaking at the opening of Leeds & Northrup's new $2 million research laboratory, Dr. Allen V. Astin, director of the National Bureau of Standards, pointed out that the growth of any company depends on keeping up with the swift advances in modern technology. Every company, he said, should maintain a scientific staff, even if the staff consists of only one man. He added:

"The technological advancement of business depends on a proper state of mind, that of seeking to improve one's product, to develop new ones and to improve basic production processes."

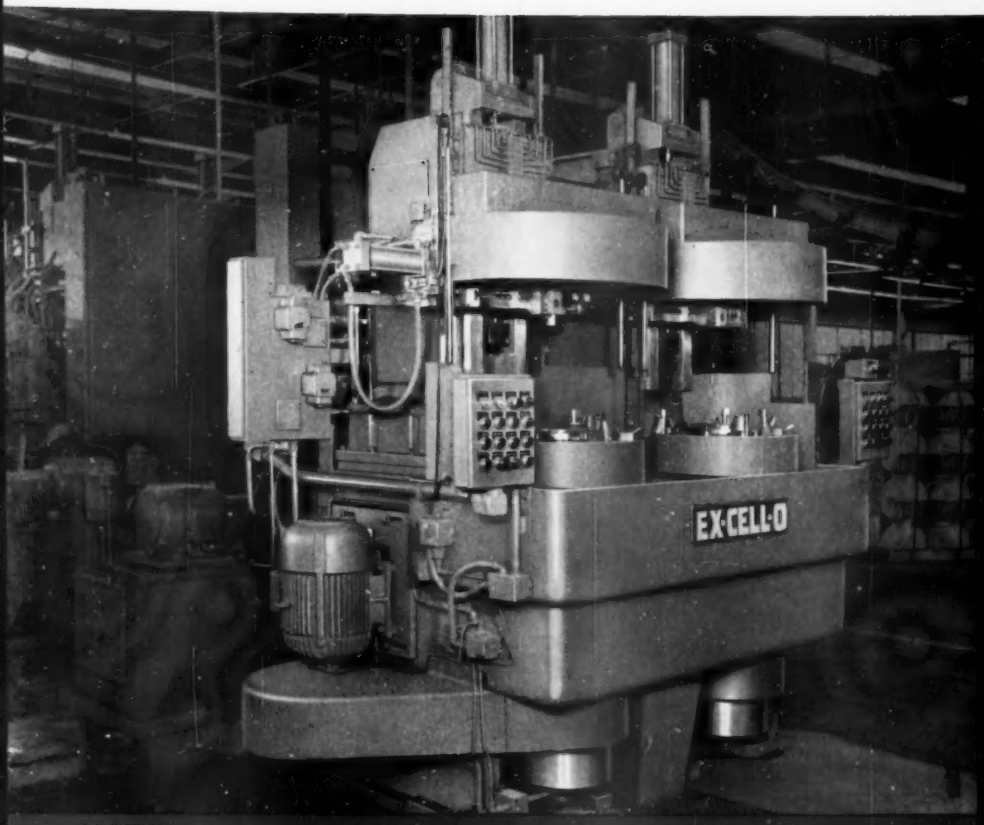
Dr. Astin's emphasis on the importance of research is shared by a large segment of industry, according to an American Management Association survey. Research and development budgets in close to 600 U. S. corporations are 12 percent higher this year than 1958's record outlay. A total of 64 percent of the firms studied increased their budgets for the development of new products and processes.

One interesting research project, being carried out by American Charcoal Co., is the application of ultrasonics to die casting. The theory behind this development is that sound waves "shake" the metal molecules together at the instant the molten metal becomes a solid. The resultant die castings should be almost 100 percent free of porosity since submicroscopic gas inclusions are completely eliminated. Findings indicate that ultimate tensile and yield strength can be increased. Ultrasonic generators and transducers can be readily attached to present die-casting and permanent-mold equipment.

Research has also resulted in the development of a method of chemically milling the honeycomb core used in aircraft and missile structures. The process, developed by Norair Div. of Northrop Corp. promises large savings over the time-consuming crushing, sawing and milling methods now used.

A block of honeycomb core is pressed into a frangible, plaster-like, water-dispersible "negative" representing the reverse side of the desired contour; the exposed portion of the honeycomb cells is masked; the negative is dissolved; and the unmasked portion is removed chemically. Chem-Mill Div. of Turco Products is refining the process.

A significant break-through has been made in heat-treat technology. Furnaces in which air is circulated at extreme velocities (up to 200 miles per hour) are being built by Surface Combustion Corp. Cooling, as well as heating, is speeded up and the uniformity of heat treatment in controlled atmospheres is improved.



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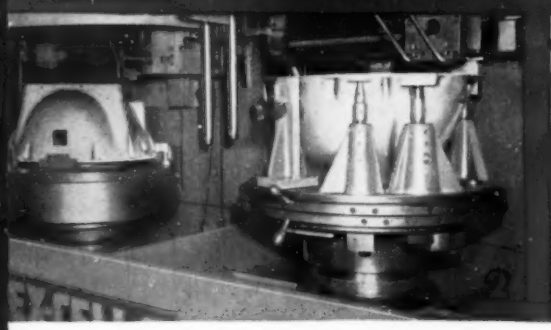
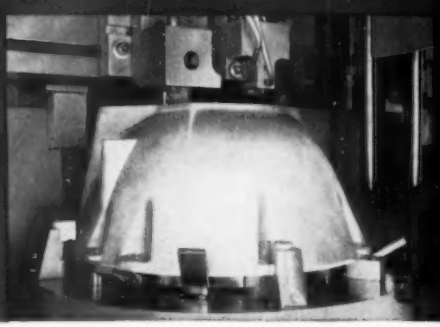
An overall view of the Ex-Cell-O Style 432 Duplex Vertical Machine, used for finish facing, boring and chamfering automatic transmission housings.



These are stations #1 and #2 of the first of the three Style 432 machines. Part at left is semi-finish faced, while part at right is finished on the opposite end by two tools each making one pass.



Close-up of housing during the finish face, bore and chamfer operations. Housings are permanent mold aluminum casting.

57-71

Want Higher Production...?

Here's how one auto manufacturer did it

Urged by the upswing in automatic transmission demand, one of the "Big Three" installed several Ex-Cell-O Duplex Vertical Boring Machines. The two-station units rough and finish permanent mold aluminum torque converter housings at a rate of 164 per hour! Automatically, of course. Operations performed by this Style 432: turning, boring, facing, grooving and chamfering, alone, or in any combination.

Perhaps you have a volume production operation you would like to *double* at no increase in per-unit cost? Then you'll want to find out all about Ex-Cell-O Vertical Boring Machines. Their two-station construction automatically doubles operator output. Get in touch with your local Ex-Cell-O Representative soon. Or, if you prefer, write direct to Ex-Cell-O, Detroit.

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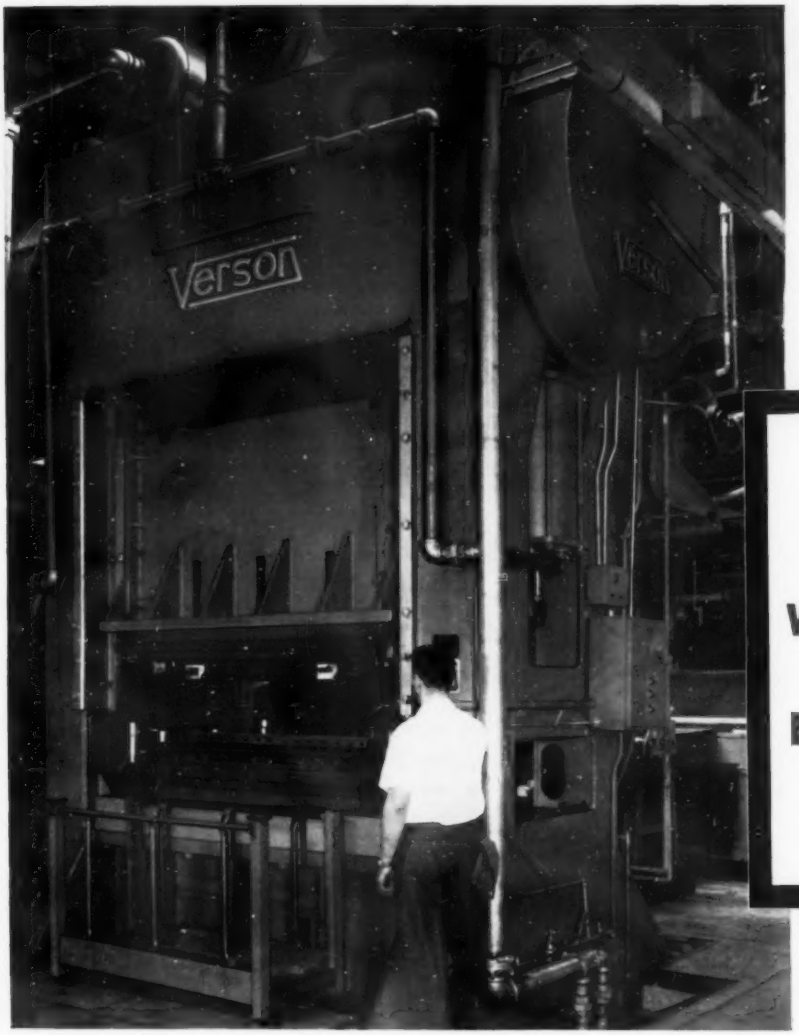

HERE'S A PROFITABLE WAY TO PRODUCE BACK RAILS FOR AUTOMOTIVE SEATS

A VERSON CRANK PRESS with a progressive die tool-up

M. P. Heinze Machine Company, Chicago, Ill., is a contract stamper who has to know how to produce profitably in a highly competitive field. As a result, equipment and processes are selected with great care. The setup shown above is a good example:

The press is a Verson 450 ton double crank machine. While it was purchased primarily for producing back rails for automotive seats, it has the versatility necessary for a wide range of jobs. Slide and bolster are 60″ x 84″. Stroke is 18″. Power adjustment of slide is 8″. It operates at 20 SPM.

The press is shown tooled with seven station back-to-front feeding progressive dies for the back rails. 59″ wide 14 ga. stock is fed from a coil.

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